

EMOTIONS AND ECONOMIC SHOCKS IN A FIRST-PRICE SEALED BID AUCTION: AN EXPERIMENTAL STUDY*

Ronald Bosman[‡] and Arno Riedl[‡]

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Abstract

We investigate experimentally whether emotions affect bidding behavior in a first price sealed bid auction. To induce emotions, we confront subjects after a first auction series with a positive or negative random economic shock. We then investigate the relation between affect and bidding behavior in a second auction series. Our main results are: (i) The economic shock has a significant effect on subjects' experienced emotions. (ii) Subjects in a bad mood place significantly higher bids whereas subjects in a good mood do not change their bidding behavior. We interpret our results in terms of risk preferences but also offer an alternative interpretation in terms of probability weighing.

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[‡]University of Amsterdam, CREED, Faculty of Economics and Econometrics, Roetersstraat 11, NL-1018 WB Amsterdam, The Netherlands, e-mail: bosman@fee.uva.nl (first author) and riedl@fee.uva.nl (second author)

1 Introduction

All humans - including economists - experience emotions and are sometimes in a good and sometimes in a bad mood. Almost everybody has experienced situations in which a decision was at least partly emotionally driven, and some introspection unquestionably convinces most people that *affect* (feelings, mood, emotions) influences decision making. Psychologists have long recognized the importance of affect in social interactions, in general, and in decision making, in particular.

In contrast to psychologists, economists have paid relatively little attention to the role of affect in decision making. This seems surprising because it appears that in many economic situations expressions of emotion can be observed. One may think of bargaining situations where people are reacting very emotionally if they feel treated unfairly, or of the vivid emotional reactions of brokers at the stock exchange when prices crash.

Only recently emotions and mood found their way into the economic literature. In a relatively early study, Frank (1988) argues that emotions can be beneficial since they help to solve important commitment problems. Loewenstein argues in a series of articles that emotions have effects on preferences not accounted for by economic theory and discusses how these effects could be incorporated into more formal models (Loewenstein 1996, 2000 and Loewenstein et al. forthcoming). Elster (1996, 1998) reviews some important findings on emotions by psychologists and discusses how economists can deal with emotions in their framework of rational choice. Finally, Thaler (2000, p. 139) predicts that in the future "Homo Economicus will become more emotional".

Though there now is a growing interest among economists in investigating and modeling the role of emotions, surprisingly little empirical economic work has been done dealing with emotions explicitly. Furthermore, all empirical studies known to us deal with either bargaining or social dilemma situations (see section 2). While sceptics may admit that emotions play a role in such environments they may argue that the real proof of the pudding for their importance in economics is whether they are also effective in economic core institutions like competitive markets and auctions.

While standard economic theory assumes stable (risk) preferences,² psychological evidence suggests that risk attitude is related to affective factors such as emotions and mood (see e.g. Loewenstein et al. forthcoming). There are psychological reasons therefore to expect that emotions and mood are also important for economic decision-making. In this paper we provide a first step in the empirical economic research of the role of emotions in competitive environments. In particular, we focus on the impact of emotions on (revealed) risk preferences in a private value auction experiment.

¹Quote from *The Winchester Star* from April 19, 2000.

²For recent notable exceptions see the articles by Caplin and Leahy (2001) and Hermalin and Isen (2000). The first authors extend the expected utility model by incorporating anticipatory emotions like anxiety. The latter also consider how emotions will affect decision making in the future.

In our experiment each subject bids in two auction series. After the first series, we confront each subject with a random economic shock, either positive or negative, to induce emotions. A positive shock entails that total earnings out of the first auction series is multiplied by a factor $k > 1$, and supplemented by a fixed amount of money. A negative shock entails that total earnings out of the first auction series is divided by k . We measure subjects' experienced emotions and mood after the shock with the help of self-reports and investigate how they influence bidding in the second auction series. Following Isaac and James (2000), it is public knowledge that subjects bid against computers that adopt the risk neutral Nash equilibrium bidding strategy. This procedure excludes strategic considerations and allows us to isolate the effect of emotions on revealed risk preferences. Subjects do not receive any feedback during the auction rounds within a series. Only after an auction series has been finished, subjects are informed about their earnings per round and their total earnings. With this procedure we can avoid learning effects and changes in subjects' emotional state other than caused by the random economic shock (e.g. frustration after not winning several rounds in a row). We discuss the experimental design more thoroughly in section 3.

In essence our set-up (embracing anonymity, lack of feedback and lack of strategic interaction) is likely to reveal only a lower bound of a possible effect of affect on bidding behavior. In addition, we can confront subjects only with a modest economic shock due to the restrictions of the experimental method. Therefore, the resulting changes in subjects emotions and moods are expected to be rather small. Nevertheless, the obtained results are rather clear-cut. (i) The economic shocks influence the emotions and mood of bidders. Bidders facing a negative shock are in a much worse mood than bidders facing a positive shock. The former report significantly higher (lower) intensities of negative (positive) emotions than the latter. (ii) Experienced emotions and mood influence bidding behavior. Subjects in a bad mood place higher bids (become more risk averse), whereas subjects in a good mood do not change their bidding behavior. We also find that cash balances and the economic shock per se do not influence bidding behavior.

The rest of the paper is organized as follows. In section 2 we first survey some relevant psychological literature on emotions and decision making. Thereafter, we shortly report on the available experimental economic evidence on emotions and mood. In section 3 we present our research questions and the experimental design. In section 4 the experimental results are reported. Section 5 closes the paper with a short summary and discussion.

2 Emotions, mood and decision making: Psychological and economic experimental evidence

Psychological evidence.³ Isen (1999, 2000) surveys evidence about the impact of positive affect on the behavior of people. Among other things it has been found that

³Because of space constraints we can only give a brief and highly selective overview of the relevant psychological literature. For detailed overviews we refer the interested reader to e.g. Isen (1999, 2000) and Loewenstein et al. (forthcoming).

positive affect leads people to elaborate and think more thoroughly in decision tasks. Moreover, it promotes variety seeking among safe and pleasant products as well as intrinsic motivation in working on a task. There is also evidence that, in general, people in a good mood are more likely to help strangers (see e.g. Cunningham, 1979; Isen and Levin, 1972). In contrast to this evidence, Isen and Simmonds (1978) find that people in a good mood are less likely to help a stranger when helping behavior is likely to induce bad feelings. Isen and her colleagues conclude that people in a good mood generally try to maintain that mood (mood maintenance hypothesis).

Psychological evidence suggests that people who are in a positive emotional state have different attitudes toward risk than those who are in a neutral or negative emotional state (Isen 1999, 2000). Although “happy” decision makers are generally more optimistic about their chances of winning in a lottery, they are less risk seeking than subjects in a neutral or negative mood (Isen and Patrick 1983). Other studies show that different emotions may affect risk taking in different ways. For example, Raghunathan and Pham (1999) find that anxious individuals are biased towards low risk/low reward options whereas sad individuals tend to go for high risk/high reward options. Anxiety, they argue, primes an implicit goal of uncertainty reduction while sadness primes reward replacement. Other studies have found that people in good mood tend to make optimistic judgments and choices whereas people in bad mood tend to make pessimistic judgment and choices (see Loewenstein et al., forthcoming, and the references cited therein). Leith and Baumeister (1996) find that angry or embarrassed subjects are more prone to risk taking than subjects in a sad or neutral state. They argue that a negative emotion in combination with high arousal leads to less careful rational thought and, through this way, to increased risk taking. Lerner and Keltner (forthcoming) find that fear and anxiety (i.e. negative feelings) tend to favor cautious, risk averse, behavior whereas anger promotes risk seeking. Another group of researchers (Eisenberg, Baron and Seligman, 1996) also find that anxiety is positively correlated with risk aversion.

In summary, there is little disagreement among psychologists that emotions and mood affects decision making, including attitudes towards risk. However, there is some disagreement how positive and negative emotions precisely affect behavior in risky situations. In particular, it appears that different emotions affect risk taking in different ways.

Economic experimental evidence. Bosman and van Winden (forthcoming) investigate the impact of emotions on retaliation in an appropriation game. They identify emotions as a new source of efficiency costs because individuals are willing to give up scarce resources in order to punish an authority that puts a claim on their resources. They also find that these emotional reactions appear to be quite robust since they also occur when groups decide or when individuals have to work for their resources. Charness and Grosskopf (1999) investigate whether a person’s level of (self-reported) happiness influences the taste for social comparisons in variants of the dictator game. They do not find a strong correlation between happiness and payoff inequity aversion. However, they report some correlation between unhappiness and the willingness to lower another person’s payoff below one’s own payoff. Kirchsteiger, Rigotti and Rus-

tichini (2000), investigate the effect of mood on decisions in two-person gift exchange games. They induce good and bad mood by showing the subjects a funny movie and a sad movie, respectively. They report that their mood induction procedure is effective and that the second players' (i.e. those who may reciprocate) behavior is dependent on their mood state. In particular, they find that bad mood leads to stronger reciprocal behavior whereas good mood induces more generosity. In another experiment, Pillutla and Murnighan (1996) investigate rejections in an ultimatum game. They find that intentional low offers triggers feelings of anger and wounded pride and ultimately spiteful behavior. Finally, we mention a video experiment by Hennig-Schmidt (1999) suggesting that emotions play a crucial role in breaking up group bargaining.

Overall, the economic experiments support the psychological evidence that affective factors are important in decision making. However, all these experimental economic studies deal exclusively with either bargaining or social dilemma situations. Our experiment differs substantially from these other studies because we focus on how emotions influence individual decision making in an auction. To the best of our knowledge, this is the first study that assesses the impact of emotions in a competitive environment.

3 Experimental design and research questions

Experimental design. In total 126 subjects, almost all undergraduate students from the university of Amsterdam, participated in the experiment. They were divided over seven experimental sessions. About 70 percent of the subjects were students of economics or econometrics while the other students came from various fields such as chemistry, psychology, and mathematics. Subjects received a show-up fee of 5 Dutch guilders (approximately 2 USD), independent of their earnings in the experiment. On average, subjects were paid out 27 Dutch guilders (approximately 11 USD) in total. An experimental session took about one hour. All sessions were run at the CREED-laboratory of the University of Amsterdam in June and October 2000.

The experimental procedure is as follows. At the beginning of a session subjects are told that the experiment consists of two parts that are independent of each other (a specimen of the instructions is provided in Appendix B). Furthermore, they are told to receive the instructions for the second part only after the end of the first part of the experiment. In the first part, each subject has to bid against four computerized bidders in a series of 35 first-price sealed bid auctions.⁴ The computerized bidders are programmed to bid according to the risk-neutral Nash equilibrium strategy (see below). In each round all private values (including those of the computerized bidders) are independently drawn from a uniform distribution with support $[0, 500]$ Dutch cents. Subjects do not get any feedback during these 35 bidding rounds, except for 5 practice rounds where they receive information about whether they have won the auction or not, and their profit. Since our focus is on investigating the effect of emotions and mood via an exogenous economic shock on bidding behavior we have decided to give subjects no feedback in order to avoid learning and (possible) mood disturbances over

⁴Walker et al. (1987) find that the use of computerized competitors, instead of human rivals, generally does change subjects' bidding behavior.

the rounds.⁵ It is important to note that subjects are aware of the fact that they play against computerized bidders that bid according to a fixed rule.⁶ Before subjects start the 35 bidding rounds, we also give them information about the procedure determining their earnings of part 1 of the experiment. This procedure entails that with a 50 percent chance all their profits are multiplied with factor two and supplemented with an additional amount of 10 guilders (positive economic shock), and with a chance of 50 percent all their profits are divided by two (negative economic shock).⁷

Directly after part 1 of the experiment, i.e. after the positive or negative economic shock but before they receive instructions for part 2, subjects are asked to fill out a questionnaire with questions concerning their experienced emotions and mood. Subsequently, part 2 of the experiment starts. This part is exactly the same as part 1, except that in part 2 there are no practice rounds. After the end of the second part, subjects receive another questionnaire with questions about their motivations and background (age, gender, etc.).

A key feature of the experiment is the measurement of subjects' experienced mood and emotions directly after the economic shock. To assess the emotions subjects experienced after part 1, we give them a list of 14 emotion names and ask them to report the intensity of each emotion on a 7-point scale, ranging from "no emotion at all" to "high intensity of the emotion". The list includes the following emotions:⁸ sadness, happiness, shame, fear, envy, hope, anger, anxiety, joy, irritation, contempt, surprise, disappointment, nervousness. Note that the list not only includes the type of emotions that one may expect to be relevant in our setting, such as happiness/joy (in case of a positive economic shock) and sadness/disappointment (in case of negative shock). A variety of other both positive and negative emotions are included, in order to avoid that subjects are 'pushed' in a particular direction. Before we measure experienced emotions we assess subjects' mood in a graphical way. To that purpose, subjects are given three series of figures (provided in Appendix C) and are asked for each series to select the figure that best describes how they currently feel.⁹ The first series of figures measures what psychologists call 'valence' and can be seen as a general indicator of mood or affect. The second series measures feeling of control while the last series measures experienced arousal of the autonomic nervous system.

Although assessing emotions with the help of self-reports may seem problematic, emotion theorists see it is a valuable method of measurement. According to Ortony, Clore, and Collins (1988, p.6) "There is as yet no known objective measure that can

⁵Emotional disturbances over the rounds may arise when subjects know whether or not they won in a particular auction round. In order to investigate how self reported mood affects bidding in the second part, we wanted to have control over subjects mood in part 2 and therefore give them as little information as possible.

⁶Subjects are told that each computerized bidder always bids $\frac{4}{5}$ of its private value.

⁷To determine the outcome of this procedure, we ask subjects individually to throw a die under supervision of the experimenter. Further, note that the positive shock, in contrast to the negative shock, includes a lump sum payment of 10 guilders. We have chosen this lump sum payment to assure that a positive shock has also economic consequences for those bidders that earn relatively little in the auction.

⁸The order of emotion names here is the same as in the questionnaire (see Appendix C).

⁹These figures, developed by Lang (1980) as a paper and pencil version of the so-called Self Assessment Manikin, are reprinted from Sonnemans (1991).

conclusively establish that a person is experiencing some particular emotion, just as there is no known way of establishing that a person is experiencing some particular color. In practice, however, this does not normally constitute a problem because we are willing to treat people’s reports of their emotions as valid. Because emotions are subjective experiences, like the sensation of color or pain, people have direct access to them, so that if a person is experiencing fear, for example, that person cannot be mistaken about the fact that he or she is experiencing fear”.

Research questions. In investigating bidding behavior, we follow Isaac and James (2000) and focus mainly on bidders’ (revealed) risk preferences that are consistent with the Constant Relative Risk Aversion Model (CRRAM) introduced by Cox et al. (1988).¹⁰ This model supplies an explicit Nash equilibrium bid function of the form

$$b_i = \frac{n-1}{n-1+r_i}v_i, \quad (3.1)$$

where v_i is the uniformly distributed and independently drawn private value for bidder i from (in our experiment) the interval $[0, 500]$, r_i the relative risk aversion parameter, and n the number of bidders. We estimate for each bidder a linear bid function of the form

$$b_{it} = \alpha_i + \beta_i v_{it} + \epsilon_{it}, \quad (3.2)$$

where t denotes an auction round. For CRRAM consistent bidders (i.e. those with $\alpha_i = 0$) this allows us to infer subject’s risk preferences, which are given by $r_i = (n-1)(1-\beta_i)/\beta_i$. Our first research question is whether subjects bidding behavior changes over the two auction series in the experiment. Since each subject bids in both parts, we can compare the estimated risk preferences within a subject. Our second research question is to establish whether random economic shocks affect the emotions and mood experienced by subjects. The third question, which becomes particularly relevant if risk preferences change over the two parts of the experiment, is whether and, if so, how emotions and mood affect bidding. Given the possibility that different emotions have different effects on risk taking, our experiment should be informative in this respect as well. Besides affect, other factors, in particular experience, may also be relevant for understanding changes in subjects’ bidding behavior. There is experimental evidence, reviewed by Kagel (1995), that experienced bidders (those who have participated in several auction series) bid significantly higher than inexperienced

¹⁰Recently, there has been a debate about whether expected utility theory can be applied to explain risk-averse behavior for both small-stakes gambles used in laboratory experiments and large-stakes gambles observed in every day life. Rabin (2000) provides a calibration theorem that shows that “within the expected-utility model, anything but virtual risk neutrality over modest stakes implies manifestly unrealistic risk aversion over large stakes” (pp.1281-82). Rabin’s theorem has convinced some researchers that expected utility models couldn’t be used to explain one-sided deviations from risk neutrality as is often observed in laboratory experiments. In a response to Rabin’s paper, Cox and Sadiraj (2001) claim that the calibration theorem only applies to a certain class of expected utility models, namely that of terminal wealth. In addition, they argue that there is no empirical support for Rabin’s hypothesized patterns of small-stakes risk aversion. Although we derive our results with the help an expected utility model, it goes beyond the scope of this paper to discuss the implications of this debate in great detail. However, in section 5 we also offer an alternative interpretation of our main finding that does not hinge on expected utility theory.

bidders. Another potentially relevant factor that we investigate, although no significant effects were found in the studies Kagel reviews, concerns a possible income or cash balance effect. By also dealing with these other factors we are able to isolate the affective one.

4 Results

In this section we first present a summary of bidding behavior. Next we investigate the impact of the economic shock on emotions and mood and, thereafter how experienced emotions and mood affect bidding behavior.

Summary of bidding behavior. The explicit linear Nash equilibrium bid function $b_i = [(n-1)/(n-1+r_i)]v_i$, where v_i is the private value and r_i the relative risk aversion coefficient, only holds for bids that do not exceed the maximum amount that would be bid by a risk neutral bidder. We therefore use a censoring technique, similar to that of Cox et al. (1988) and Isaac and James (2000), to exclude bids that are greater than what would be bid by this risk neutral bidder.¹¹ Subsequently, we have estimated the following linear bid function for each subject i ,

$$b_{it} = \alpha_i + \beta_i v_{it} + \epsilon_{it},$$

where t is the auction round, and α_i and $\beta_i = (n-1)/(n-1+r_i)$ are the parameters to be estimated.¹² Since the Nash equilibrium model requires that $\alpha_i = 0$, we limit ourselves to those subjects for whom α_i is not statistically different from zero in both auctions series, and refer to them as CRRAM consistent bidders. The reason for looking mainly at the behavior of CRRAM consistent bidders is that only their behavior can conveniently be interpreted in terms of revealed risk preferences. However, at the end of this section we also discuss some main results when all bidders are included in the analysis.

Table 1 shows the estimated slopes for all subjects and the subset of subjects who satisfy the equilibrium condition (i.e. $\alpha_i = 0$). As can be seen from table 1, about 50 percent of the subjects are CRRAM consistent bidders.¹³ Furthermore, it appears that, on average, subjects are very close to being risk neutral, particularly in part 1 of the experiment where the average slope of the bidding functions equals 0.816. In fact, we cannot reject the hypothesis that bidders are risk neutral, i.e. that the slope equals 0.8, in the first series of auctions (t-test, $p = 0.165$; Wilcoxon signed-ranks test, $p = 0.080$,

¹¹For that reason we exclude all bids larger than 400.

¹²In each auction round observations are censored between zero and the v_{it} . Since censoring values vary from observation to observation we used a generalization of Tobit estimates that allows each observation to be censored at a different point (see Amemiya, 1973).

¹³This percentage is consistent with the finding of Cox and Oaxaca (1996) who report the same percentage of CRRAM consistent bidders. We also investigated whether the estimated slopes of CRRAM consistent and CRRAM inconsistent bidders are significantly different (for both parts of the experiment). This turned out not to be the case (Mann-Whitney test, two-tailed; $p=0.48$ for part 1; $p=0.70$ for part 2).

2-sided tests). We also check whether bidding behavior of CRRAM consistent bidders is influenced by gender. This turns out not to be the case.¹⁴

TABLE 1 — SUMMARY OF ESTIMATED BID FUNCTIONS

	All bidders		CRRAM consistent bidders	
	Part 1	Part 2	Part 1	Part 2
Slope (β_i)	0.822 (0.087)	0.844 (0.095)	0.816 (0.087)	0.841 0.090
N	126		61	

Note: Reported numbers are averages; standard deviations in parentheses.

Table 1 already suggests that bidding behavior is not the same in part 1 and 2 of the experiment. This brings us to the first result.

Result 1 *Compared to part 1 of the auction, CRRAM consistent bidders place significantly higher bids (become more risk averse) in part 2 of the auction.*

Support. Using a Wilcoxon signed-ranks test, the hypothesis that the slopes do not depend on the part of the auction is rejected at $p=0.004$ (two-sided test).

The question now is why bidders have changed their behavior. In section 3, we identified three possible factors that could be relevant for bidding behavior: experience, income effects, and changes of the emotions (mood) due to the economic shock. Note that result 1 is consistent with the finding by other researchers that more experienced bidders typically place higher bids. Before we look at the effect of emotions and mood on bidding behavior, we investigate the impact of an economic shock per se.

Result 2 *(i) Compared to part 1 of the auction, CRRAM consistent bidders confronted with a positive economic shock place significantly higher bids in the part 2 of the auction. (ii) CRRAM consistent bidders confronted with a negative shock change their bidding behavior only marginally.*

Support. The average estimated slope of the bid function for CRRAM consistent bidders confronted with a positive shock (negative shock) is 0.841 (0.791) in the first part of the auction and 0.871 (0.812) in the second part of the auction.¹⁵ For bidders faced with a positive economic shock, the hypothesis that the slopes do not depend on the

¹⁴Applying a Mann-Whitney test to the estimated slopes, the differences between female and male participants are not significant in both parts for CRRAM consistent bidders ($p = 0.37$ in part 1, $p = 0.34$ in part 2; two-sided tests).

¹⁵The hypothesis that the estimated slopes of CRRAM consistent bidders who are confronted with a positive shock and who are confronted with a negative shock do not differ is rejected in the first and second series of auctions (Mann-Whitney test, $p < 0.05$, two-tailed). For the first part of the auction this is a rather surprising result, for which we have no explanation.

part of the auction has to be rejected ($p=0.018$, two-tailed Wilcoxon signed-ranks test). For bidders faced with a negative shock, this hypothesis can only be rejected at the 10 percent level ($p=0.075$, two-tailed Wilcoxon signed-ranks test).

Result 2 is consistent with an experience effect (i.e. more experienced bidders place higher bids). Apart from an experience effect, we hypothesize that economic shocks may influence the emotions (mood) of bidders, and through this way, bidding behavior. Before we investigate the second part of this hypothesis, we first assess whether bidders' experienced emotions and mood are indeed related to the type of economic shock.

Economic shocks and emotions. Table 2 shows the intensity scores of experienced emotions and the scores on general mood, feeling of control, and arousal for CRRAM consistent bidders. The second column gives the average scores of bidders confronted with a positive economic shock, while the third column shows the average scores of bidders confronted with a negative shock. As can be seen from this table, the intensity of emotions and mood triggered by the two different types of economic shock appear to be different in a number of cases. The next result bears this out.

Result 3 *Compared to bidders confronted with a negative economic shock, those confronted with a positive economic shock experience significantly more happiness and joy, significantly less disappointment, and marginally less significant sadness. In addition, bidders faced with a positive economic shock report to have a significant better mood than those faced with a negative shock.*

Support. Using a Mann-Whitney test, the hypothesis that the scores on emotions and mood indicators of bidders confronted with a positive and negative economic shock are drawn from the same distribution is rejected for the above mentioned emotions and mood indicators (see column four of table 2).

Note that all differences in emotion and mood scores are in the predicted direction. Bidders confronted with a positive shock experience positive emotions more intensely and negative emotions less intensely than bidders confronted with a negative shock. We therefore conclude that *economic shocks have important affective consequences.*

Before we investigate whether and, if so, how emotions and mood affect bidding behavior, we first look at the relation between mood and emotions. Table 5 in Appendix A shows the pair wise correlations between mood, feeling of control, arousal, and the emotions. The next result deals with the relation between mood and emotions.

Result 4 *The score on the general mood item is a good indicator of the emotional state of a subject.*

Support. The score on the general mood item is strongly correlated with the emotion scores, in the predicted direction. (Note that the higher the score on the mood item the worse the mood.) Mood is significantly negatively correlated with control, happiness and joy, and significantly positively correlated with sadness, shame, fear, envy, anger, anxiety, irritation, contempt and disappointment ($p < 0.01$ for all correlation statistics, see Appendix A).

TABLE 2 — REPORTED INTENSITY SCORES OF EMOTIONS
(CRRAM BIDDERS ONLY)

Shock: Emotion	positive Mean	negative Mean	Diff.
(bad) mood	3.40 (2.30) [‡]	5.94 (2.61)	2.54***
control	5.50 (1.55)	4.87 (2.41)	-0.63
arousal	6.07 (2.35)	5.68 (2.48)	-0.39
sadness	2.33 (1.77)	3.19 (1.92)	0.86*
happiness	4.37 (1.35)	2.74 (1.65)	-1.63***
shame	1.67 (1.24)	2.45 (1.98)	0.79
fear	1.70 (1.54)	1.65 (1.25)	-0.06
envy	2.17 (1.98)	2.42 (1.80)	0.25
hope	4.27 (1.86)	3.77 (2.00)	-0.49
anger	2.27 (1.74)	3.03 (2.04)	0.77*
anxiety	2.23 (1.83)	2.77 (1.77)	0.54
joy	4.50 (1.61)	2.68 (1.51)	-1.82***
irritation	2.80 (1.96)	3.39 (1.98)	0.59
contempt	2.00 (1.58)	2.32 (1.85)	0.32
surprise	3.90 (1.83)	3.42 (2.29)	-0.48
disappointment	2.70 (2.10)	4.90 (1.60)	2.20***
nervousness	2.27 (1.64)	2.32 (1.64)	0.06
N	30	31	

Note: [‡] Standard deviations in parentheses. *** significance at the 1 percent, ** at the 5 percent, and * at the 10 percent level; two-sided Mann-Whitney test. The intensity scale for mood, control, and arousal ranges from 1 to 9. The intensity scale for emotions ranges from 1 (no emotion) to 7 (high intensity).

In the analysis that follows, we will use the score on the general mood indicator as an index of how a subject feels. Although general mood correlates strongly with many emotions – in particular the ones that we predicted to be important (happiness/joy and sadness/disappointment) – there appear to be some exceptions, namely hope, surprise, and nervousness. Since these emotions are not captured by our index, we will investigate their possible effect on bidding behavior separately.¹⁶

¹⁶We have also investigated whether emotions or general mood are influenced by gender. It turns out that female bidders experience more anxiety and fear than male bidders (two-tailed Mann-Whitney test, $p < 0.05$).

Emotions, mood, and bidding behavior. Psychological literature typically reports an asymmetric effect of good and bad mood on risk preferences (see section 3). For the investigation whether mood influences bidding behavior it is therefore a natural starting point to distinguish between good and bad mood only. For this sake we create a binary variable based on the score of the general mood item which was shown to be a good indicator for the emotional state of a subject. If the score on the mood item is lower than 5, the mood dummy is set equal to one and represents a good mood. If the score is equal or higher than 5, the dummy is set equal to 0 and represents a bad mood.¹⁷ The next result deals with the effects of mood on risk taking.

Result 5 *CRRAM consistent bidders who experience a bad mood are significantly more risk averse in part 2 of the auction than in part 1 of the auction. CRRAM consistent bidders who experience a good mood do not change their bidding behavior.*

Support. The average estimated slope of the bid function for CRRAM consistent bidders in a bad (good) mood is 0.8040 (0.8294) in the first part of the auction and 0.8360 (0.8464) in the second part of the auction.¹⁸ Using a Wilcoxon signed-ranks test, the hypothesis that the estimated slopes are the same in both parts of the auction has to be rejected for bidders in a bad mood ($p=0.002$) but not for those bidders who experience a good mood ($p=0.306$).

This is an important and surprising result. Although it supports the psychological findings of asymmetric mood effects on subjects' risk preferences, it seems not in line with the observation of psychologists that positive affect typically reduces risk seeking. In the next section we come back to this result and discuss it in light of this psychological evidence.

In the following, we further explore this asymmetric mood effect. In particular, we investigate their robustness with respect to income (cash balance) and those emotions not correlated with the mood index. To this end we have estimated a logit model with, as dependent variable, a risk aversion dummy that is equal to 1 if a subject becomes more risk averse (i.e. the slope of the estimated bid function of part 1 minus that of part 2 is smaller than zero) and zero otherwise. As explanatory variables we have considered the general mood index, the emotions that are not captured by this mood index (hope, surprise, and nervousness), the arousal level (that is also not correlated with mood), the pre-economic-shock-earnings of part 1, the economic shock dummy (equal to one if the shock is positive, zero otherwise), and gender. Note, that if, after controlling for mood and emotions, income (cash balance) effects play a role this should show up in significant coefficients of the economic shock dummy and/or pre-economic-shock-earnings of part 1. The following result is obtained.

¹⁷This distinction between good and bad mood emerges quite naturally from the expressions on the faces in the mood item (see appendix C). The results we obtain with this binary variable are robust to some variation in this mood dummy (e.g. an increase or decrease by one unit of the interval where the dummy is equal to zero).

¹⁸We cannot reject the hypothesis that the estimated slopes of CRRAM consistent bidders who are in a good mood and who are in a bad mood do not differ in the first or second series of auctions (Mann-Whitney test, $p > 0.30$, two-tailed).

Result 6 *In addition to mood (indicated by the general mood index) only hope significantly affects the likelihood that a CRRAM consistent bidder will become more risk averse in part 2 of the auction. Nervousness has only a marginal effect. Neither the economic shock per se nor the pre-economic-shock-earnings of part 1 are significant.*

Support. Table 3 shows the result of the logit estimate. Significant results are obtained for the score on general mood ($p = 0.045$) and hope ($p = 0.016$). The coefficients for both variables are positive. Nervousness turns out to be marginally significantly negative ($p = 0.053$).

TABLE 3 — LOGIT ESTIMATES: DETERMINANTS OF LIKELIHOOD TO BECOME MORE RISK AVERSE (CRRAM BIDDERS)

DEPENDENT VARIABLE: more risk averse				
Independent variables	Coefficient	Std.err.	z-value	p-value
economic shock	0.3384	0.7634	0.44	0.658
pre-shock-earning	0.0027	0.0018	1.55	0.121
mood	0.3204	0.1597	2.01	0.045
arousal	0.0194	0.1458	0.13	0.894
hope	0.4940	0.2050	2.41	0.016
surprise	0.2353	0.1701	1.38	0.167
nervousness	-0.4434	0.2293	-1.93	0.053
sex	0.6993	0.7685	0.91	0.363
constant	-4.1590	1.8729	-2.22	0.026
N = 61				
LR $\chi^2_{(8)} = 16.43$				
Prob $> \chi^2 = 0.037$				
Pseudo $R^2 = 0.21$				
Log L = -31.06				

Result 6 shows that the worse a bidder's mood, the higher the likelihood that he or she will become more risk averse in part 2 of the auction.¹⁹ In the next section we shall discuss this result in light of the psychological evidence.

Note, although hope is a positive emotion its effect on the likelihood of becoming more risk averse is similar to that of (bad) mood. In addition, the negative constant turns out to be significant, which could be interpreted as an experience effect. This interpretation is consistent with the experimental evidence reviewed by Kagel (1995) that more experienced bidders have a tendency to bid in a more risk-averse way. There is no significant effect of the pre-economic-shock-earnings of part 1. From this we conclude that income or cash balance effects, after taking emotions and mood into account, are not very important. In addition, we do not find any effect of the economic

¹⁹We have also run an OLS-regression with the slope difference between part 1 and part 2 as independent variable and the same set of explanatory variables as in Result 6. It turns out that the signs of the explanatory variables are the same as those reported in Table 3. They are, however, not significant.

shock dummy. It is therefore not the economic shock per se but the changes in subjects' emotions and mood due to the shock that changes risk preferences. Finally, it turns out that nervousness marginally lowers the likelihood of becoming more risk averse.

So far, we have restricted our analysis to CRRAM consistent bidders only (i.e. bidders for whom α_i is not statistically different from zero in both series of auctions). We now briefly discuss what happens when all bidders and all bids are included in the analysis. Overall, the results are similar. First, it turns out that bidders confronted with a positive shock as well as bidders confronted with a negative shock place significantly higher bids in the second auction (Result 2). Second, the economic shock has a significant effect on reported emotions and mood (Result 3).²⁰ The score on the general mood item is again a good indicator of the emotional state of a bidder (Result 4). Finally, our main finding - that is, bidders who are in a bad mood place higher bids in the second auction, while bidders who are in a good mood do not change their bidding behavior - also holds when all bidders are used (Result 5). Note that if all bidders are used we cannot interpret the results in terms of revealed risk preferences any more. However, in the next section where we discuss our results we offer an alternative interpretation of our main result in terms of probability weighing that does not hinge on the expected utility model.

5 Summary and discussion

Our research question was whether emotions, induced by a random economic shock, affect bidding behavior in a first price sealed bid auction. We found that economic shocks (positive or negative) have important consequences for the emotional state of bidders. Furthermore, we observed that the emotional state of a bidder is related to his or her bidding behavior. In particular, we found that bidders who are in a bad mood, place significantly higher bids given their private value, while bidders with a good mood do not change their bidding behavior. It is thus not the economic shock per se that changes bidding behavior but changes in subjects' emotions and mood due to the shock. Of other potentially relevant factors such as gender, cash balance and experience, only the latter turns out to be important.

An interesting question now is why bidders' emotions and mood are important for their bidding behavior. We offer two interpretations of our results and discuss them in light of the psychological studies discussed in section 2. The first interpretation assumes that the CRRAM model holds and focuses on bidders revealed risk preferences. The second interpretation goes beyond the expected utility model and explains behavior in terms of probability weighing.

Although psychologists only recently have begun investigating the relation between emotion and risk taking, the evidence suggests that positive affect typically reduces risk seeking in the domain of gambling and lottery tasks (except when risk is low and success more likely, which usually leads to more risk seeking). With regard to negative

²⁰Significant results are obtained for mood, feeling of control, happiness, joy, sadness, envy, anger, anxiety, irritation, and disappointment (Mann-Whitney test, two-tailed). All differences in emotion and mood scores are again in the predicted direction.

affect, the psychological evidence is less conclusive: different negative emotions appear to affect risk taking in different ways. As we discussed in 4.2.2, if the CRRAM model holds then our results can be interpreted in terms of risk preferences. Bidders who are in a good mood do not change their risk attitude, while bidders in a bad mood become less risk seeking. How to link up this interpretation of our results with the psychological evidence? Let us start with positive affect. Psychologists hypothesize that people with a good mood generally want to maintain that mood and therefore avoid (high) risks. This kind of behavior is typically found when subjects must choose between a safe and risky lottery. In this context the risky lottery may appear unappealing because it could potentially destroy one's good mood - in case the negative outcome is realized. The possible negative outcome of the risky lottery seems quite salient but can easily be avoided by choosing the safe option. In a first-price auction, the possible negative consequences of risk taking (bidding given one's private value) are much less transparent compared to lotteries where probabilities and outcomes are explicitly stated. So, bidders who are in a good mood and who are motivated to maintain that mood by avoiding high risks may believe that the best (safest) way to proceed is to stick to their bidding strategy of the first series of auction rounds. More generally, it appears that the effects of positive affect on risk taking are institution dependent.

With regard to negative affect, we take as a starting point that negative emotions are experienced as painful. They serve as a signal to the individual that something has gone wrong. The individual therefore has an incentive to change something in his or her environment in order to feel good again.²¹ We assume that the bidder with a bad mood focuses on the possibility to 'break even' emotionally, which may affect risk taking in an asymmetric way. The idea is as follows. If the bidder believes that the (high) rewards of a more risk seeking bidding strategy are sufficient to compensate for his or her current mood, then this strategy becomes very appealing. On the other hand, if the bidder believes these rewards are too marginal to improve the current mood, then a more risk averse strategy becomes attractive (because it prevents an even more negative mood and assures a small positive gain). Our interpretation here is that bidders with a bad mood believe that it is not possible to break even emotionally by employing a more risk seeking bidding strategy, and prefer the relatively safe reward that can be obtained by making higher bids.²² There is experimental evidence reported by Thaler and Johnson (1990) that is consistent with this interpretation. More specifically, they find in the context of gambling that if individuals have had prior losses, they become

²¹Interestingly, bidders who are CRRAM consistent in part 1 but who become CRRAM inconsistent in part 2 reported to have experienced significantly more fear, envy, anger, irritation, and contempt compared to bidders who are CRRAM consistent in both parts (Mann-Whitney test, two-tailed, $p < 0.05$). This result suggests that negative emotions, in particular emotions with a high arousal, motivates subjects to change their behavior.

²²In the questionnaire that subjects received after part 2 of the experiment we asked them the minimal amount of money they want to earn in an experiment such as ours. If we take this minimal amount as their aspiration level, it is unlikely that, on average, bidders confronted with a negative shock are able to reach this aspiration level. (The average minimal amount that CRRAM bidders faced with a negative shock want to earn is 22.9 guilders, while in part 1 and 2 of the auction these bidders pre-shock earnings are on average 4.3 and 4.9 guilders, respectively.) In other words, even from a monetary point of view, it seems unlikely that bidders can compensate their losses relative to their aspirations.

more risk averse when there is not the opportunity to break even (i.e. get back to their original pre-loss wealth position). If there does exist a possibility to break even, then individuals typically become more risk seeking in gambling. Interestingly, Thaler and Johnson refer to affect as an appealing possible explanation for this type of behavior.²³

The second interpretation of our results goes beyond the expected utility model. It explains the observed changes in bidding behavior with the help of probability weighing, which reflects the idea that individuals have a tendency to transform objective probabilities into subjective weights (for an overview of this concept in non-expected utility theory, see Starmer, 2000). For example, there is evidence that people tend to overestimate small risks, while at the same time they underestimate large risks. With regard to emotions, psychological evidence shows that people experiencing negative affect are more pessimistic in their judgements, whereas people experiencing positive affect are found to be more optimistic. Applied to our auction, this evidence suggests that, given the bid, mood is likely to change the bidder's perception of the probability of winning the auction. This evidence is consistent with our finding that bidders in a bad mood place higher bids in the second auction series but is at odds with our observation that bidders with a good mood do not change their bidding behavior. However, when people have to make a decision in a risky situation there is also evidence that people in whom positive affect has been induced focus more on the outcome of a risky choice rather than on probability in order to avoid possible losses (Nyrgen et al., 1996). In other words, bidders with a good mood do change their bidding behavior because they are concerned with maintaining their mood and to that end focus more on outcomes than on probabilities. On the other hand, bidders in a bad mood are likely to focus on the probability of winning and bid higher because in their perception this probability has become lower.

We see several interesting directions for future research. First, it would be interesting to investigate the effects of emotions and mood under different institutions. As we argued in the introduction, the first-price sealed bid auction is a very competitive environment where emotions have relatively little room to influence behavior. Moreover, the possible negative consequences of bidding are not very transparent, which, we argued, is likely to mitigate the effect of (positive) affect on risk taking. If we already find systematic mood effects in such a competitive market environment where risk is not particularly salient, similar or perhaps even stronger effects may be expected under other (market) institutions where risk is involved (e.g. decisions on insurance, saving, and pensions). Second, in many economic decision situations individuals often have the opportunity to delay their decisions. Consequently, these decisions may be less impulsive and emotion driven. An interesting question is whether emotions, and their effects on behavior, are robust with respect to time. Some recent work on bargaining shows that anger type emotions can be quite robust because they show up (again) when one actually has to make a decision (Bosman et al. 2001). Whether the behavioral effects of emotions and mood (due to an economic shock) on risk taking are also robust in this sense seems an interesting issue. Finally, it would be interesting to further explore

²³Another explanation they offer is that subjects who have had losses "might feel that they aren't very lucky that day, and that their actual chance of winning is lower than the stated probability". Basically, this explanation is equivalent to the interpretation of our results below in terms of probability weighing.

how different emotions affect risk taking. We found that negative emotions such as sadness and disappointment (which are generated by the economic shock and strongly related to mood) typically make bidders bid higher, whereas nervousness (which is not related to the economic shock and mood) appears to have an opposite effect on bidders' behavior. Furthermore, the positive emotion hope (also not related to the shock and mood) appears to have a similar effect on bidding behavior as sadness and disappointment. By changing the cause of the economic shock different type of emotions could be generated and investigated. For example, if a negative shock were not random but the result of the action of another agent who could be held responsible, anger rather than sadness/disappointment type of emotions would be likely to prevail.

6 References

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A Correlations between emotions and mood measures

TABLE 4 — PAIR WISE CORRELATIONS BETWEEN EMOTIONS AND MOOD MEASURES
(ALL BIDDERS)

Emotion	mood	control	arousal	sadness	happiness	shame	fear	envy
mood	1.00							
control	-0.52 (0.00)	1.00						
arousal	-0.11 (0.23)	-0.06 (0.51)	1.00					
sadness	0.60 (0.00)	-0.47 (0.00)	-0.09 (0.30)	1.00				
happiness	-0.74 (0.00)	0.47 (0.00)	0.10 (0.28)	-0.56 (0.00)	1.00			
shame	0.39 (0.00)	-0.33 (0.00)	0.10 (0.29)	0.34 (0.00)	-0.30 (0.00)	1.00		
fear	0.29 (0.00)	-0.31 (0.00)	-0.08 (0.40)	0.33 (0.00)	-0.19 (0.03)	0.39 (0.00)	1.00	
envy	0.48 (0.00)	-0.38 (0.00)	-0.02 (0.80)	0.54 (0.00)	-0.47 (0.00)	0.29 (0.00)	0.36 (0.00)	1.00
hope	-0.09 (0.31)	0.05 (0.58)	0.16 (0.08)	0.05 (0.58)	0.24 (0.01)	-0.01 (0.95)	0.11 (0.22)	0.07 (0.47)
anger	0.52 (0.00)	-0.41 (0.00)	-0.08 (0.38)	0.57 (0.00)	-0.51 (0.00)	0.40 (0.00)	0.23 (0.01)	0.70 (0.00)
anxiety	0.30 (0.00)	-0.28 (0.00)	0.06 (0.53)	0.48 (0.00)	-0.25 (0.01)	0.43 (0.00)	0.64 (0.00)	0.39 (0.00)
joy	-0.71 (0.00)	0.42 (0.00)	0.09 (0.30)	-0.54 (0.00)	0.81 (0.00)	-0.25 (0.01)	-0.18 (0.05)	0.42 (0.00)
irrit	0.56 (0.00)	-0.25 (0.00)	-0.18 (0.04)	0.54 (0.00)	-0.46 (0.00)	0.29 (0.00)	0.22 (0.02)	0.57 (0.00)
contem	0.40 (0.00)	-0.16 (0.08)	-0.12 (0.19)	0.51 (0.00)	-0.34 (0.00)	0.42 (0.00)	0.34 (0.00)	0.66 (0.00)
surprise	0.02 (0.87)	-0.04 (0.67)	-0.07 (0.43)	0.04 (0.67)	0.06 (0.52)	0.26 (0.00)	0.25 (0.01)	0.17 (0.06)
disap	0.72 (0.00)	-0.41 (0.00)	-0.11 (0.21)	0.59 (0.00)	-0.56 (0.00)	0.24 (0.01)	0.16 (0.08)	0.53 (0.00)
nervous	0.14 (0.11)	-0.22 (0.01)	0.01 (0.91)	0.26 (0.00)	-0.05 (0.59)	0.30 (0.00)	0.36 (0.00)	0.22 (0.02)

Emotion	hope	anger	anxiety	joy	irrit	contem	surprise	disap	nervous
hope	1.00								
anger	-0.04 (0.67)	1.00							
anxiety	0.21 (0.02)	0.39 (0.00)	1.00						
joy	0.25 (0.00)	-0.41 (0.00)	-0.24 (0.01)	1.00					
irrit	-0.06 (0.54)	0.72 (0.00)	0.34 (0.00)	0.45 (0.00)	1.00				
contem	0.06 (0.54)	0.66 (0.00)	0.40 (0.00)	0.29 (0.00)	0.64 (0.00)	1.00			
surprise	0.28 (0.00)	0.20 (0.03)	0.27 (0.00)	0.05 (0.57)	0.16 (0.08)	0.23 (0.01)	1.00		
disap	0.04 (0.63)	0.60 (0.00)	0.29 (0.00)	0.58 (0.00)	0.60 (0.00)	0.42 (0.00)	0.17 (0.06)	1.00	
nervous	0.07 (0.43)	0.30 (0.00)	0.46 (0.00)	0.05 (0.60)	0.26 (0.00)	0.28 (0.00)	0.28 (0.00)	0.18 (0.04)	1.00

Note: p-values in parentheses.

TABLE 5 — PAIR WISE CORRELATIONS BETWEEN EMOTIONS AND MOOD MEASURES (CRRAM BIDDERS)

Emotion	mood	control	arousal	sadness	happiness	shame	fear	envy
mood	1.00							
control	-0.44 (0.00)	1.00						
arousal	-0.12 (0.38)	-0.24 (0.07)	1.00					
sadness	0.49 (0.00)	-0.40 (0.00)	-0.03 (0.85)	1.00				
happiness	-0.72 (0.00)	0.47 (0.00)	0.07 (0.57)	-0.52 (0.00)	1.00			
shame	0.52 (0.00)	-0.37 (0.00)	0.01 (0.91)	0.53 (0.00)	-0.46 (0.00)	1.00		
fear	0.27 (0.03)	-0.22 (0.09)	-0.11 (0.41)	0.41 (0.00)	-0.27 (0.04)	0.30 (0.02)	1.00	
envy	0.37 (0.00)	-0.44 (0.00)	-0.02 (0.87)	0.61 (0.00)	-0.45 (0.00)	0.48 (0.00)	0.39 (0.00)	1.00
hope	-0.07 (0.57)	0.05 (0.68)	0.14 (0.27)	0.06 (0.64)	0.24 (0.06)	-0.08 (0.56)	0.22 (0.09)	0.13 (0.33)
anger	0.38 (0.00)	-0.35 (0.01)	0.10 (0.44)	0.43 (0.00)	-0.41 (0.00)	0.70 (0.00)	0.18 (0.16)	0.70 (0.00)
anxiety	0.33 (0.01)	-0.33 (0.01)	0.04 (0.77)	0.62 (0.00)	-0.43 (0.00)	0.52 (0.00)	0.70 (0.00)	0.61 (0.00)
joy	-0.68 (0.00)	0.45 (0.00)	0.06 (0.67)	-0.56 (0.00)	0.80 (0.00)	-0.38 (0.00)	-0.32 (0.01)	0.33 (0.01)
irrit	0.53 (0.00)	-0.21 (0.11)	-0.10 (0.46)	0.50 (0.00)	-0.38 (0.00)	0.48 (0.00)	0.29 (0.03)	0.60 (0.00)
contem	0.35 (0.01)	-0.05 (0.69)	-0.27 (0.04)	0.42 (0.00)	-0.27 (0.04)	0.58 (0.00)	0.25 (0.06)	0.58 (0.00)
surprise	0.03 (0.80)	0.02 (0.86)	-0.06 (0.67)	0.03 (0.82)	0.04 (0.79)	0.35 (0.01)	0.26 (0.04)	0.15 (0.25)
disap	0.71 (0.00)	-0.28 (0.03)	-0.09 (0.48)	0.49 (0.00)	-0.56 (0.00)	0.41 (0.00)	0.20 (0.13)	0.52 (0.00)
nervous	0.09 (0.50)	-0.19 (0.14)	0.10 (0.45)	0.27 (0.04)	-0.08 (0.53)	0.34 (0.01)	0.41 (0.00)	0.29 (0.03)

Emotion	hope	anger	anxiety	joy	irrit	contem	surprise	disap	nervous
hope	1.00								
anger	0.00 (0.99)	1.00							
anxiety	0.24 (0.07)	0.52 (0.00)	1.00						
joy	0.31 (0.01)	-0.27 (0.04)	-0.35 (0.01)	1.00					
irrit	0.13 (0.33)	0.69 (0.00)	0.47 (0.00)	-0.29 (0.02)	1.00				
contem	0.07 (0.62)	0.67 (0.00)	0.40 (0.00)	-0.18 (0.16)	0.70 (0.00)	1.00			
surprise	0.21 (0.10)	0.24 (0.06)	0.23 (0.07)	0.02 (0.86)	0.11 (0.38)	0.21 (0.11)	1.00		
disap	-0.02 (0.88)	0.52 (0.00)	0.27 (0.03)	-0.57 (0.00)	0.67 (0.00)	0.45 (0.00)	0.16 (0.23)	1.00	
nervous	0.15 (0.24)	0.25 (0.05)	0.55 (0.00)	-0.16 (0.22)	0.24 (0.07)	0.26 (0.05)	0.23 (0.08)	0.16 (0.21)	1.00

Note: p-values in parentheses.

B Instructions

The experiment of today consists of two parts. You can earn money in both parts. The amount you earn depends, among other things, on your own decisions. Both parts are independent of each other. This means that your earnings in part 1 do not influence your earnings in part 2, and vice versa. Your total earnings in the experiment will be paid out to you privately at the end. This means that other participants will not know how much money you earn in the experiment. You will see the instructions of the experiment presently. If part 1 has been finished, part 2 will start. You will receive the instructions of part 2 when part 1 has been finished. If you have a question during the experiment, please raise your hand. One of us will come to you to answer your question. You ought to be quiet during the experiment and refrain from communicating with others.

Part 1

The first part of the experiment consists of 35 rounds. You are a buyer in a market with four other buyers during all 35 rounds. The other buyers are not participants but computerized buyers. In each round you can bid on a fictitious good. The value that this fictitious good has for you will be determined randomly in each round. The computer system randomly selects a number from 0 up to and including 500. This number represents the value of the fictitious good in cents. Each number from 0 up to and including 500 has an equal chance of being selected. For each buyer in the market, thus also for the computerized buyers, a value is drawn independently. This means that your value and all of the values of the computerized buyers are nearly always different. These values are private and will not be known by other buyers. The value of the fictitious good can be seen as the price at which you can sell the good. You thus receive a new value in each round and can bid on the good a single time. You can only bid in whole cents. If your bid is the highest bid, you buy the good at the price that you bid. Your profit is equal to the difference between your value and the price that you paid.

$$\text{Profit} = \text{Value} - \text{Price}$$

If your bid is not the highest, you earn nothing. If two or more buyers have placed the same highest bid, one buyer will be randomly selected to buy the fictitious good.

Suppose your value is 450 cents. It is not possible to place a bid that is higher than your value. You bid 300 and have the highest bid. In this case your profit is equal to $450 - 300 = 150$ cents (1.5 guilders). Suppose your bid is not the highest. In that case you earn nothing.

The four computerized buyers with whom you are in the market always bid according to a fixed rule. They are programmed to bid always $4/5$ of their value. Note, that in each round a value from 0 up to and including 500 is randomly drawn for each computerized buyer separately. During the 35 rounds you do not get any information about the bids of the computerized buyers. You also do not get any information about which bid is the highest or how much profit you have made. When the 35 rounds are over, you will receive information about your profit per round and total profit over all rounds.

Before the 35 rounds start, you can first bid in a number of practice rounds. You cannot earn money in these practice rounds. Their purpose is to make you conversant with the bidding procedures. In contrast to the real 35 rounds, you do receive information in each round about your profit during the practice rounds. When the practice rounds have been finished, you again have the opportunity to ask questions. Subsequently, the 35 rounds will start where you can earn money.

Earnings part 1

Your earnings of part 1 are determined by a procedure with the total profit you have made in all 35 rounds as a starting point. This procedure will be explained after the practice rounds.

If you have a question at this moment, please raise your hand. If there are not any question, the practice rounds will start instantly.

[subjects do practice rounds]

Before the 35 rounds start where you can earn money, information about the procedure used to determine your earnings of part 1 will be given. This procedure takes as a starting point your total profit over the 35 rounds. After these 35 rounds, each participant will be asked to throw a die individually a single time under supervision. If the die shows an even (2, 4, or 6) number, your total profit will be multiplied with factor two and you will receive an extra of 10 guilders. If the die shows an uneven (1, 3, or 5) number, your total profit will be divided by two.

Finally, it is noted that during the 35 rounds you do not receive any information about your profit per round. When the 35 rounds are over, you will receive information about your profit per round and total profit over all rounds.

[subjects do part 1]

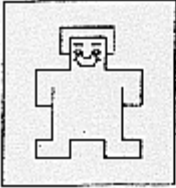
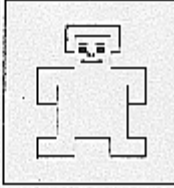
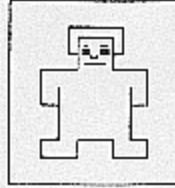
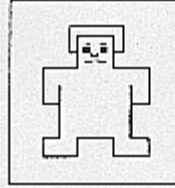
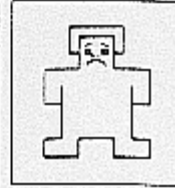

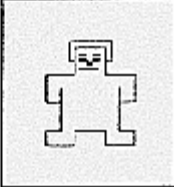
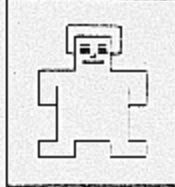
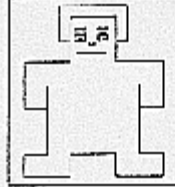
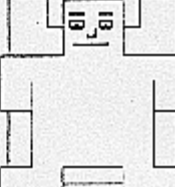

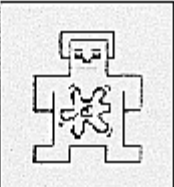

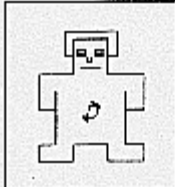
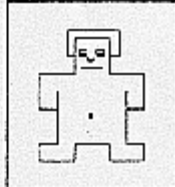
Part 2

Part 2 of the experiment will start instantly. Part 2 is exactly the same as part 1 of the experiment. You are again a buyer in a market with four other, computerized, buyers. Again, there are 35 rounds where you can bid on the fictitious good. The value of the fictitious good for each buyer is randomly drawn from 0 up to and including 500. Your earnings of part 2 of the experiment will be determined by the same procedure as in part 1. This means that after 35 rounds, you again ought to throw a die. If the die shows an even (2, 4, or 6) number, your total profit of part 2 will be multiplied with factor two and you will receive an extra of 10 guilders. If the die shows an uneven (1, 3, or 5) number, your total profit of part 2 will be divided by two. When part 2 has been finished, you will again be asked to fill out a short questionnaire. Subsequently, subjects are paid and the experiment ends. In part 2 there not any practice rounds. When the 35 round start, you can immediately earn money. Note that you will receive information about profit per round and total profit over all rounds when the 35 rounds are over.

C Emotions and mood questionnaires

Mood questionnaire (translated from Dutch)

How do you feel at this moment? Choose in each row below with the help of the figures the number that best describes how you currently feel (choose one number in each row).

								
1	2	3	4	5	6	7	8	9
								
1	2	3	4	5	6	7	8	9
								
1	2	3	4	5	6	7	8	9

Emotion questionnaire (translated from Dutch)

We would like to have some information about how you feel at this moment. We ask you to go through the following list of emotion names. Subsequently, we ask you to report the intensity of each emotion you experience at this moment.

Sadness:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Happiness:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Shame:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Fear:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Envy:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Hope:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Anger:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Anxiety:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Joy:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Irritation:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Contempt:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Surprise:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Disappointment:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
Nervousness:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense

If you believe that one or several other emotion words describe your experience better, please report these words and intensities below:

.....:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
.....:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense
.....:	Not at all	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Very intense