# ONLINE APPENDIX

Off the Charts: Massive Unexplained Heterogeneity in a Global Study of Ambiguity Attitudes

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# Contents

1	Cha	aracteristics country by country	2
2	Cor	nsistency checks and attenuation analysis	3
	2.1	Consistency checks	3
	2.2	Out of sample predictions	4
	2.3	Relations of dominance between prospects	5
		2.3.1 Relations of dominance between prospects $(i/8:x;0)$ and $(j/8:x;0)$	6
		2.3.2 Relations of dominance between prospects $(i/8:x;0)$ and $(i/8:x;5)$	7
3	Dis	strust of the experimenter: Pilot results	10
	3.1	Methods and setup	10
	3.2		11
4	Inst	tructions	13

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# 1 Characteristics country by country

Table A.1: Number of subjects per country and principal characteristics

country	$\mathrm{Sub.s}$	For.s	age	$_{\mathrm{male}}$	econ	$_{\mathrm{math}}$	$_{\rm natural}$	hum	arts	social	PPP/€	language	University	GDP	Gini
Australia	61	6	25.41	0.656	0.262	0.180	0.131	0.098	0.049	0.033	2 AUD	English	University of Adelaide	39,466	.305
Belgium	91	13	20.64	0.451	0.418	0.055	0.088	0.066	0.022	0.132	€1	French	University of Liege	38,633	.280
Brazil	84	1	20.86	0.683	0.964	0.000	0.000	0.012	0.000	0.000	2 Real	Portuguese	Escola de Administraão, São Paolo	11,719	.547
Cambodia	80	0	20.74	0.375	0.000	0.212	0.237	0.125	0.175	0.175	1500 Riel	Khmer	University of Phnom Penh	2,373	.444
Chile	96	0	21.46	0.479	0.000	0.000	0.229	0.000	0.000	0.260	500 Pesos	Spanish	Universidad de Conception	17,125	.521
China	204	0	21.55	0.608	0.127	0.451	0.181	0.083	0.005	0.064	4 RMB	Chinese	Jiao Tong, Shanghai	8,442	.480
Colombia	128	0	21.21	0.500	0.062	0.797	0.047	0.031	0.023	0.008	1500 Pesos	Spanish	Universidad de Medellin	10,103	.560
Costa Rica	106	5	22.71	0.666	0.292	0.179	0.113	0.009	0.019	0.132	500 Colones	Spanish	Universidad de Costa Rica, San Jose	12,236	.503
Czech Rep.	99	2	22.38	0.606	0.485	0.111	0.051	0.121	0.030	0.091	20 Kronas	Czech	Charles University, Prague	25,949	.310
Ethiopia	140	1	21.14	0.657	0.593	0.107	0.079	0.021	0.000	0.093	6 Birr	English	Addis Ababa University	1,116	.300
France	93	8	21.30	0.527	0.430	0.054	0.022	0.043	0.032	0.032	€1	French	University of Rennes 1	35,194	.327
Germany	130	32	26.52	0.515	0.115	0.400	0.108	0.115	0.008	0.023	€1	German	Technical University, Berlin	39,414	.270
Guatemala	84	1	22.20	0.464	0.345	0.179	0.000	0.119	0.036	0.131	6 Quetzales	Spanish	Universidad Francisco Marroquín	4,961	.559
India	89	0	21.01	0.303	0.697	0.000	0.022	0.112	0.090	0.034	22 Rupees	English	University of Kolkata	3,650	.368
Japan	84	0	21.74	0.512	0.095	0.417	0.107	0.107	0.000	0.048	120 Yen	Japanese	Hiroshima Shudo University	34,278	.376
Kyrgyzstan	97	2	20.02	0.485	0.639	0.000	0.000	0.072	0.000	0.289	25  KGS	Russian	University of Bishkek	2,424	.362
Malaysia	64	0	20.09	0.578	0.578	0.188	0.062	0.000	0.016	0.047	2 Ringgit	English	University of Nottingham Malaysia	15,589	.462
Nicaragua	120	1	20.94	0.550	0.917	0.025	0.000	0.000	0.000	0.000	10 Córdobas	Spanish	Universidad National Autonoma	2,940	.405
Nigeria	202	2	22.65	0.495	0.406	0.000	0.005	0.054	0.312	0.119	110 Naira	English	University of Lagos	2,532	.437
Peru	95	1	23.66	0.463	0.579	0.368	0.000	0.011	0.000	0.042	2 N. Soles	Spanish	Instituto del Peru	10,318	.460
Poland	89	1	24.00	0.517	0.427	0.079	0.067	0.169	0.000	0.124	2.4 Zloty	Polish	University of Warsaw	21,281	.341
Russia	70	8	20.56	0.500	0.729	0.129	0.000	0.086	0.000	0.014	22 Rubles	Russian	Higher School of Economics	21,358	.420
Saudi Arabia	65	12	21.74	1.000	0.585	0.308	0.000	0.000	0.000	0.000	4 Riyal	English	King Fahd University	24,434	.570
South Africa	71	18	22.44	0.606	0.451	0.254	0.056	0.056	0.014	0.042	8 Rand	English	University of Cape Town	11,035	.650
Spain	80	3	20.94	0.513	0.450	0.037	0.000	0.100	0.037	0.225	€1	Spanish	Universidad Pompeu Fabra	32,701	.320
Thailand	79	0	20.59	0.354	0.329	0.101	0.139	0.000	0.013	0.215	20 Baht	Thai	University of Khon Kaen	8,703	.536
Tunisia	74	0	22.26	0.527	0.230	0.473	0.081	0.000	0.000	0.000	2 Dinar	French	Université Libre de Tunis	9,415	.400
UK	80	0	20.77	0.450	0.700	0.000	0.025	0.013	0.025	0.075	1 Pound	English	King's College London	36,511	.350
USA	97	22	21.32	0.495	0.144	0.206	0.113	0.041	0.031	0.186	\$ 1	English	University of Michigan Ann Arbor	48,442	.450
Vietnam	87	0	20.20	0.575	0.667	0.057	0.034	0.000	0.011	0.023	8000 Dong	Vietnamese	Ho-Chi-Minh-City University	3,435	.357
Total	2939	139	21.83	0.530	0.402	0.189	0.069	0.056	0.040	0.089			v	· · · · · · · · · · · · · · · · · · ·	

Sub.s stands for number of subjects, For.s for number of foreigners; econ etc. indicate study majors; PPP/€indicates exchange rates in purchasing power parity used for conversion Gini coefficients are taken from the World Bank where available, else from the CIA World Factbook; 2011 or closest available GDP refers to 2011 values in PPP, current US Dollars; source: World Bank

# 2 Consistency checks and attenuation analysis

# 2.1 Consistency checks

In the main text, we only used stimuli with zero lower outcomes in order to keep our analysis simple. We can, however, now use the four additional choice list pairs providing non-zero lower outcomes to test for consistency of responses. In particular, the choice list pairs with probabilities 1/8 and 7/8 were repeated with a lower outcome consisting of the PPP-equivalent of €5 instead of 0. Notice how this mimics the repetition by Dimmock, Kouwenberg, Mitchell and Peijnenburg (2015) of some choices with a probability of the known urn of plus or minus 10%.

Indeed, taking the 0 lower outcome away and replacing it with  $\in$ 5 reduces the ambiguity of a choice, since the complementary probability is now assigned to a positive outcome (and vice versa for losses). This in turn means that ambiguity aversion predicts that ambiguity premia for the prospects with non-zero lower outcomes (i/8:x;5) with i=1,7 ought not to be larger than those for the matched list pairs with zero lower outcomes (in absolute value) (i/8:x;0). Similarly, ambiguity seeking predicts that ambiguity premia for the prospects with non-zero lower outcomes ought not to be lower than those for the matched list pairs with zero lower outcomes. For losses, both predictions have opposite signs.

Table 2 shows the number of choices incompatible with ambiguity aversion and ambiguity seeking for each of the four possible comparisons between prospects. Table 2 also shows the percentage of choices incompatible with either ambiguity aversion or ambiguity seeking in the four additional choice lists. Our empirical data indicate moderate proportions of violations, around 24 to 28 %. Notice how the figures are similar to the violation

rates reported by Dimmock et al. (2015), who reported that 42% of subjects responded in an inconsistent manner (not counting indifferences). This provides evidence that the levels of nosie in the two data sets are indeed quite similar.

	Gains, $i = 1$	Gains, $i = 7$	Losses, $i = 1$	Losses, $i = 7$
nbr. ambiguity aversion	432	623	439	372
nbr. ambiguity seeking	235	161	166	336
total percentage violations	23.75	27.91	21.57	25.23

Table 2: Consistency check: number and percentage of incompatible repeated choices

# 2.2 Out of sample predictions

We used the individual-level parameters generated from the multilevel regression model described by Eq. (??) to generate out-of-sample predictions for the prospects (i/8:x;5) with i=1,7. These predictions assume that utility is linear. With non-linear utilities, utility of outcome y=5 remains unknown and in-sample predictions of ambiguity premia on prospects (i/8:x;0), i=1,2,3,5,6,7 cannot be directly used to generated out-of-sample predictions of ambiguity premia on (i/8:x;5), i=1,7.

Table 3 shows the Spearman correlation coefficients for the comparisons between the elicited ambiguity premia and the predicted premia on prospects (i/8:x;5), i=1,7 for gains and losses.

	Gains, $i = 1$	Gains, $i = 7$	Losses, $i = 1$	Losses, $i = 7$
correlation	0.229	0.466	0.109	0.096
p-value	< 0.001	< 0.001	< 0.001	< 0.001
N	2808	2810	2802	2803

Table 3: Descriptive statistics out-of-sample predictions,

The low level of correlation between the measured ambiguity premia and the predicted ambiguity premia found in out-of-sample predictions is confirmed by the Spearman correlations between the measurements on prospects (i/8:x;0) and (i/8:x;5), i=1,7.

Table 4 shows these correlations for ambiguity premia. For the sake of comparison Table 4 also shows the correlations for the certainty equivalents under risk and under uncertainty. Table 4 shows that correlations between measurements on prospects (i/8:x;0) and (i/8:x;5), i=1,7 were not only low in absolute terms, but also much lower for ambiguity premia than for certainty equivalents under risk and uncertainty.

	Gains, $i = 1$	Gains, $i = 7$	Losses, $i = 1$	Losses, $i = 7$
ambiguity premia	0.239	0.535	0.398	0.350
certainty equivalents, risk	0.439	0.694	0.592	0.660
certainty equivalents, uncertainty	0.441	0.686	0.633	0.720

**Table 4:** correlations between measurements on prospects (i/8:x;0) and (i/8:x;5), i=1,7.

# 2.3 Relations of dominance between prospects

In this section we provide evidence on the violations of first-order stochastic dominance between prospects. Two type of relations of dominance can be investigated with our data. First, we can compare the certainty equivalents for prospects (i/8:x;0) and (j/8:x;0), where i and j denote the number of balls associate with the highest outcome in absolute value. For gain prospects, the relation of dominance implies:

$$i > j \Leftrightarrow ce_{i+}^r \ge ce_{j+}^r$$
 and  $ce_{i+}^u \ge ce_{j+}^u$ 

and similarly, for losses:

$$i < j \Leftrightarrow ce_{i-}^r \ge ce_{j-}^r$$
 and  $ce_{i-}^u \ge ce_{j-}^u$ 

Second, we can compare the certainty equivalents for prospects (i/8:x;0) and (i/8:x;5), with i=1,7. For gains, the relation of dominance implies that the certainty

equivalent for (i/8:x;5) is larger or equal the certainty equivalent for (i/8:x;0). For losses, the relation of dominance implies the opposite.

# **2.3.1** Relations of dominance between prospects (i/8:x;0) and (j/8:x;0)

Our data contains 6 rank-ordered prospects in terms of likelihoods i/8 (i = 1, 2, 3, 5, 6, 7). This implies 15 possible comparisons in terms of first order stochatic dominance. For each subject and for each of these possible violations violations, we evaluated the violations of first-order stochastic dominance for gains and losses, under risk and uncertainty.

Table 5 shows the average percentages of violations of first-order stochastic dominance for gains and losses under risk. Numbers below the diagonal correspond to the percentage of violations in the gain domain. Numbers above the diagonal correspond to the percentage of violations in the loss domain.

	j = 1	j=2	j=3	j=5	j=6	j = 7
i = 1		14.25	11.65	8.35	7.29	6.20
i = 2	20.65		13.19	7.87	6.54	6.17
i = 3	16.37	13.85		8.45	6.64	6.61
i = 5	7.66	6.77	7.25		11.55	8.14
i = 6	6.60	5.89	6.60	11.50		10.18
i = 7	6.06	5.85	5.96	7.42	9.19	

Table 5: Average percentage violations of First-Order Stochastic Dominance under risk

Table 6 shows the average percentages of violations of first-order stochastic dominance for gains and losses under uncertainty. Numbers below the diagonal correspond to the percentage of violations in the gain domain. Numbers above the diagonal correspond to the percentage of violations in the loss domain.

Comparison of Tables 5 and 6 shows that percentage of violations were comparable across sources of uncertainty and signs (gains vs. losses). We ran a two-way repeated-measure ANOVA, with sign (gains vs. losses) as the first factor and source of uncertainty

	j = 1	j=2	j=3	j=5	j=6	j = 7
i = 1		18.20	13.90	9.03	7.67	6.24
i = 2	17.93		15.20	8.22	7.60	5.73
i = 3	13.44	13.47		8.93	7.43	6.24
i = 5	8.00	8.55	8.89		12.44	8.63
i = 6	7.11	7.45	8.03	12.19		10.84
i = 7	5.89	6.02	6.47	9.64	11.20	

Table 6: Average percentage violations of First-Order Stochastic Dominance under uncertainty

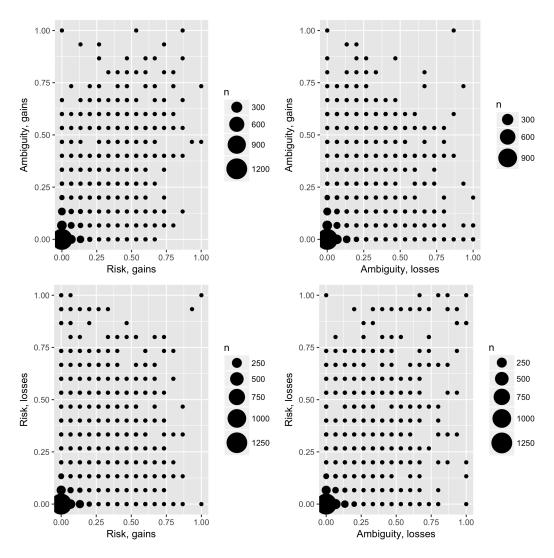
as the second factor, on the percentage of first-order stochastic dominance violations. The value of the intercept is 8.9 % (p-value: 0). We found no evidence for a sign effect (coefficient on gain dummy: 0.003, p-value: 0.392). We found a significant source effect, but with a rather small coefficient for the uncertainty dummy (coefficient equal to 0.009, p-value: 0.002). Therefore, uncertainty raised modestly the percentage of first-order stochastic dominance violations by 0.9%. We found no interaction between source and sign (p-value: 0.283).

Last, we show evidence for violations of first-order stochastic dominance at the individual level. Figure 1 shows the four possible comparisons at the subject level.

# **2.3.2** Relations of dominance between prospects (i/8:x;0) and (i/8:x;5)

Our data contains 8 pairs of rank-ordered prospects in terms of outcomes: two in the gain domain with i = 1,7 under risk and under uncertainty, two in the loss domain under risk and under uncertainty. Table 7 shows the average percentages of violations of first-order stochastic dominance for gains and losses under risk. Numbers below the diagonal correspond to the percentage of violations in the gain domain. Numbers above the diagonal correspond to the percentage of violations in the loss domain.

Table 8 shows the average percentages of violations of first-order stochastic dominance for gains and losses under risk. Numbers below the diagonal correspond to the



**Figure 1:** Individual violations of first-order stochastic dominance on prospects (i/8:x;0) and (j/8:x;0), i=1,2,3,5,6,7

percentage of violations in the gain domain. Numbers above the diagonal correspond to the percentage of violations in the loss domain.

Comparison of Tables 7 and 8 shows that percentage of violations were comparable across sources of uncertainty and signs (gains vs. losses). We ran a two-way repeated-measure ANOVA, with sign (gains vs. losses) as the first factor and source of uncertainty as the second factor, on the percentage of dominance relations. The value of the intercept is 19.9 % (p-value: 0). We found evidence for a sign effect (coefficient on gain dummy:-0.064, p-value: <0.001). We also found a significant source effect, with smaller coefficient (coefficient for the uncertainty dummy equals to -0.024, p-value: -0.001). Therefore,

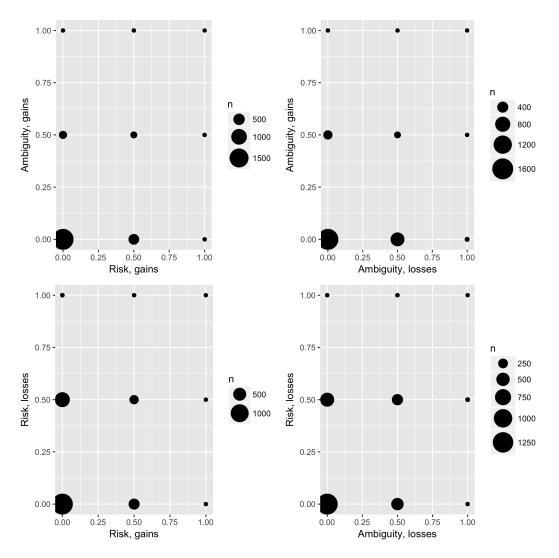
	y = 0, i = 1	y = 5, i = 1	y = 0, i = 7	y = 5, i = 7
y = 0, i = 1			7.52	
y = 5, i = 1				32.24
y = 0, i = 7	8.97			
y = 5, i = 7		17.93		

**Table 7:** Average percentage violations of First-Order Stochastic Dominance under risk, assuming linear utility

	y = 0, i = 1	y = 5, i = 1	y = 0, i = 2	y = 5, i = 2
y = 0, i = 1			8.69	
y = 5, i = 1				26.30
y = 0, i = 2	6.37			
y = 5, i = 2		12.03		

**Table 8:** Average percentage violations of First-Order Stochastic Dominance under uncertainty, assuming linear utility

both losses and risk raised the percentage of first-order stochastic dominance violations by 2.4%. We also found interaction between source and sign to be significant (p-value: 0.025). Figure 2 shows the comparisons of violations of first-order stochastic dominance at the individual level.



**Figure 2:** Individual violations of first-order stochastic dominance on prospects (i/8:x;0) and (i/8:x;5), i=1,7

# 3 Distrust of the experimenter: Pilot results

# 3.1 Methods and setup

We recruited 89 subjects at the Technical University Berlin, Germany, where also the main experiment was run. Of these, we randomly allocated 41 to a baseline which closely imitated the original experimental design. The remaining 48 were allocated to a treatment meant to test whether trust in the experimenter influenced the findings.

In general, we followed the procedures of the main experiment closely. The experiment was conducted using paper and pencil. Decision tasks with nonzero lower outcomes

and probabilities different from 0.5 were dropped from the task, in order to make the experiment somewhat shorter; and subjects were not forbidden to switch to and fro between the prospect and the sure amount. This serves to make the data comparable with the evidence collected, while at the same time abandoning some or the more restrictive assumptions.

In the baseline experiment, fixed numbers were assigned to the balls in the uncertain urn, equivalent to those of the risky urn. The treatment consisted in giving subjects a choice what balls (numbers) to bet on. Instead of assigning fixed numbers to the winning and losing balls, subjects were told that they would have to choose the numbers on which they wanted to bet. Only blank balls were displayed in the decision problems, so that subjects could write their own numbers on the balls. This procedure thus emulates the common precaution in 50-50 Ellsberg problems whereby subjects are allowed to choose the colour they want to bet on. See also Abdellaoui, Baillon, Placido and Wakker (2011) for an analogous implementation using eight coloured balls.

The null hypotheses is that it makes no difference whether subjects are allowed to choose the numbers to bet on or whether these numbers are pre-assigned, i.e. that mistrust of the experimenter plays no significant role for ambiguity attitudes. The alternative hypothesis is that we will find more ambiguity aversion when the numbers of the winning balls are preassigned. These hypotheses can be further refined according to the winning probabilities and the decision domains.

## 3.2 Results

Figure 3 shows the nonparametric ambiguity premia separately for each prospect pair. Figure 3(a) shows the results for gains, juxtaposing the baseline and treatment conditions.

It can easily be seen that no significant differences arise between the treatments. This result holds either with a parametric t-test, or with a nonparametric Mann-Whitney test. We observe a similar result for losses, shown in figure 3(b). The equality of ambiguity premia observed is indeed very clear for probabilities  $p \geq 0.25$ . While for the smallest probability it would appear that subjects are more ambiguity averse in the baseline treatment, this is not significant at conventional levels either using a t-test (t(87) = 1.60, p = 0.112), or using a Mann-Whitney test (z = 1.65, p = 0.099). We thus conclude that mistrust towards the experimenter does not play a major role for our results.

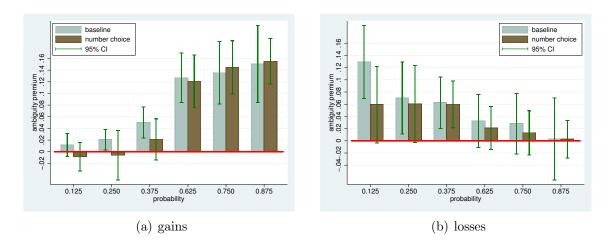


Figure 3: Differences by treatment

# 4 Instructions

# **Instructions**

Thank you for participating in this experiment in decision making! You will obtained 4 Euros for having come to the experiment—those 4 Euros are yours to keep independently of the outcomes in the experiment. In addition, you will be compensated with whatever you earn during the experiment according to the procedures described in the instructions.

The instructions will be read to you in a short while. You may consult these instructions at any time during the experiment. In case you should have any questions or doubts, please raise your hand and an experimenter will come and assist you in private.

Please consider each decision carefully. Take a careful look at outcomes and the probabilities associated to them before taking a decision. Remember that your final payoffs from this experiment will depend on the decisions you make (and of course, on chance).

Please remain seated when you are finished with the tasks. This experiment consists of two parts. Once everybody has finished the tasks in part I, new instructions will be read to you for part II. At the very end of the experiment, you will be asked to fill out a questionnaire. The answer to the questionnaire as well as all your answers to the tasks will be private, and cannot be traced back to you personally. Once you are done filling in the questionnaire, an experimenter will call you up. Your payoff will then be determined in private, you will be given the money you won, after which you can leave.

Do not talk during the experiment, or you will be immediately excluded from the experiment!

Good luck!

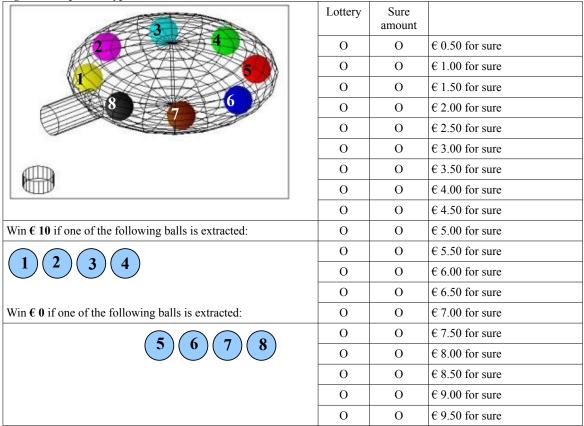
## PART I

#### Choice tasks

In the present experiment, you will be asked to choose repeatedly between a fixed amount of money and a lottery. The lottery will always give you a chance to win one of two amounts of money. Figure 1 shows a typical choice task. You are asked repeatedly to choose between playing the lottery and obtaining a sure amount of money. **For each row**, you are asked to indicate whether you would prefer to play the lottery or to obtain the sure amount of money by ticking the preferred option.

The urn indicated in the figure contains eight numbered balls. One ball will be extracted from the urn to determine your payoffs in case you should play the lottery. In the lottery displayed, if ball 1, 2, 3, or 4 is extracted, you obtain epsilon 10; if ball 5, 6, 7, 8 is extracted, you obtain nothing. Please pay close attention to the amounts to be won as well as the number of balls associated with each outcome, since they change across decisions.

Fig. 1: Example of a typical decision task



We are interested in the amount for which you will switch from preferring the lottery to preferring the sure amount. Most likely, you will begin by choosing the lottery for small sure amounts, and at a certain point switch to the sure amount as the latter increases. If you do not want the lottery at all, you can choose to get the sure amount in the first row and then continue with the sure amount for all choices (if you prefer €0.50 over the lottery you should also prefer €1.00 over the lottery, etc.). Where you will switch from the lottery to the sure amount depends entirely on your preferences—there are no right or wrong answers. However, **you should NOT switch back and forth several times between lottery and sure amount!** You will be excluded from the experiment if you do so or if it is not possible to clearly recognize your preference (for example, if you have not ticked any box for a given row or ticked both boxes for a given row).

#### Types of choices

You will be asked to take 18 decisions, for each one of which you will need to decide between a lottery and a series of sure amounts as exemplified in figure 1 above. Please pay close attention to the amounts to be won as well as the number of balls associated with each outcome! Indeed, both the higher and lower amount, as well as the number of balls, change between decision problems. Since your final payoff depends on these decisions, it is crucial for you to pay close attention to these features.

There are **two different types of lotteries** involved. Figure 2 below shows the two different types of lotteries that you will encounter. Fig 2a shows the urn already familiar from figure 1 above. It contains exactly eight (8) balls, numbered from 1 to 8.

In Urn in Fig. 2b also contains exactly eight (8) balls. However, you cannot see what numbers the balls contained in the urn have. This means that **you do not know the exact numbers that are present in that urn**. All balls bear a number between 1 and 8 inclusive (have either 1, 2, 3, 4, 5, 6, 7, or 8 written on them), but it is possible that some numbers are absent from this urn while others occur repeatedly. Thus you do not know the exact composition of the urn.

Fig. 2a: transparent urn

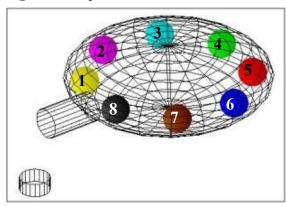
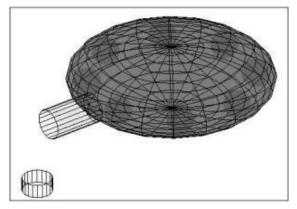


Fig. 2b: opaque urn

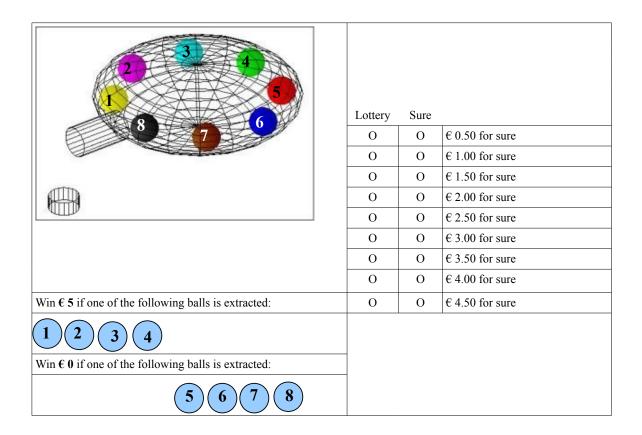


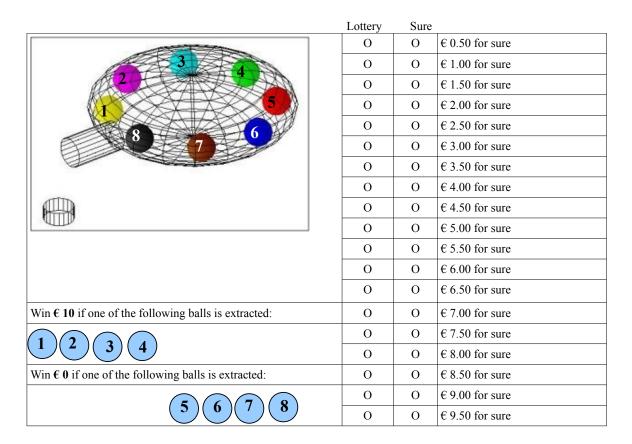
#### **Payoff determination**

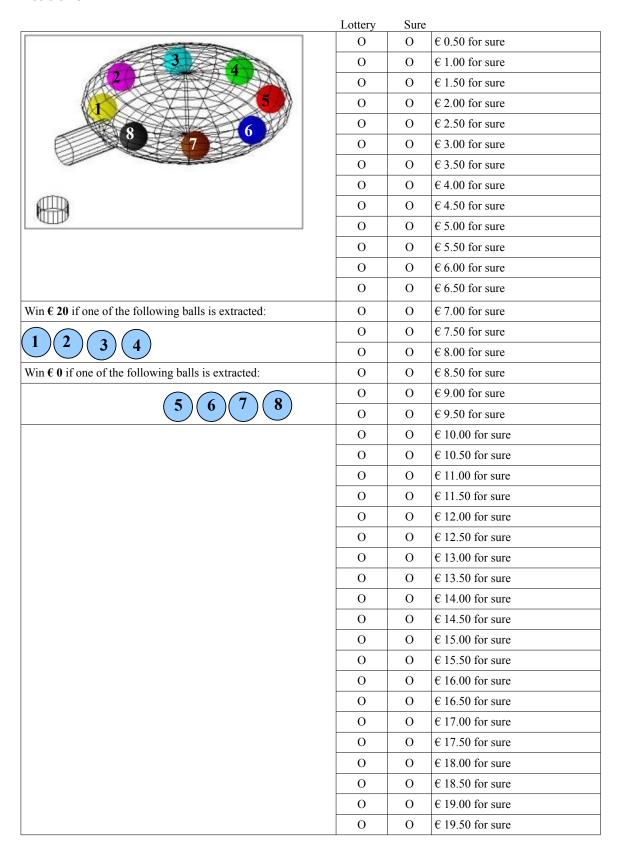
After you have taken all the decisions, one of your decisions will be randomly drawn for real pay, i.e. **the amounts indicated in the decision problem will be paid out for real**. First, either part I or part II will be selected for real play by a coin flip. If part I is selected, then one of the 18 decision tasks is drawn at random, using a chance device with equal probability for each decision task to be extracted. For the extracted decision task, one of your decisions, corresponding to one row for which you had to indicate your preference between the sure amount and the lottery, will then be drawn at random with **equal probability for each row**. If for the row that is drawn you have indicated that you prefer the sure amount of money, you will simply be paid that amount.

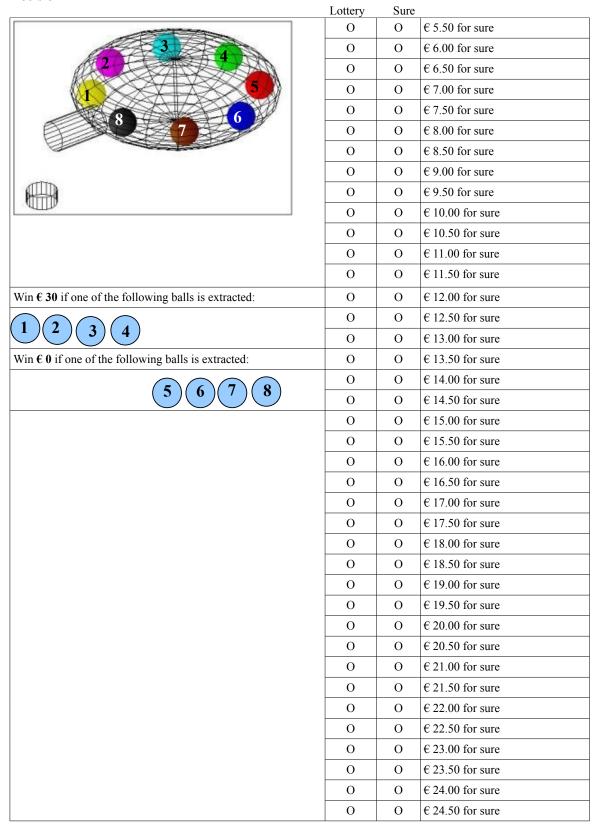
In case you have chosen the lottery for the randomly determined row, then that lottery will be played according to the probabilities indicated. For the transparent urn, this will involve drawing a ball from an urn in which all numbers from 1 to 8 inclusive are present. If you should desire to do so, you can verify that there are indeed all balls from 1 to 8 in the urn. You will then be paid the outcome corresponding to the ball you drew.

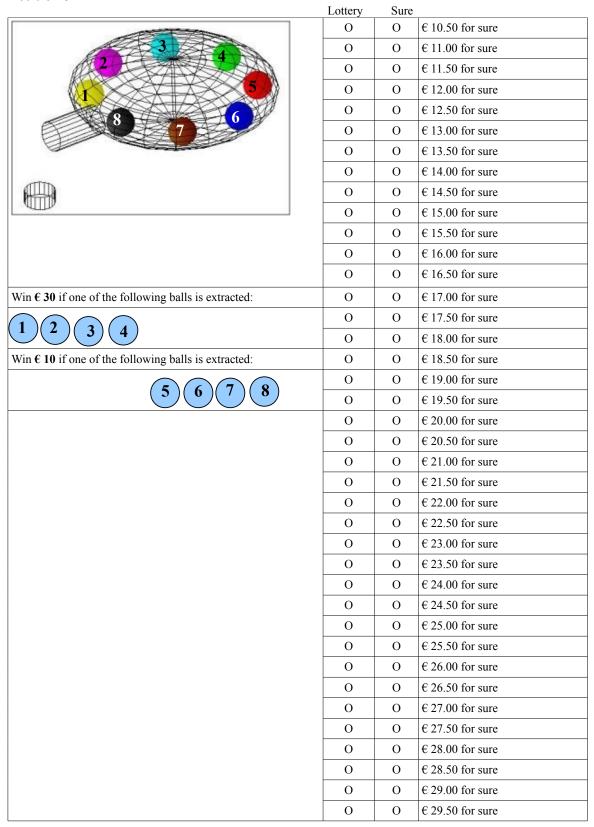
For the opaque urn, the procedure is exactly analogous, except that you will now draw a ball from a pre-composed urn, the exact composition of which you do not know. You will also be paid the outcome corresponding to the ball you drew. If you should desire to do so, after the draw you can verify that there are indeed 8 balls with numbers between 1 and 8 inclusive in the urn.

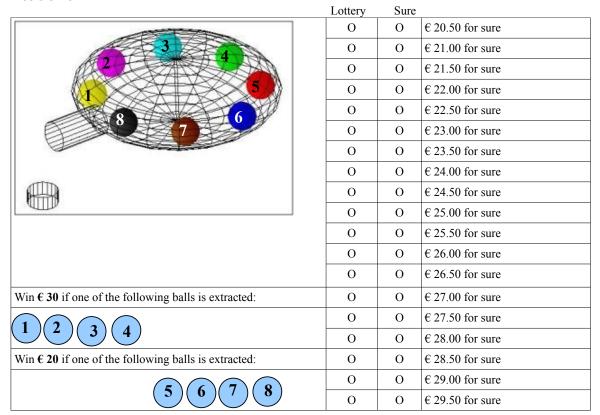


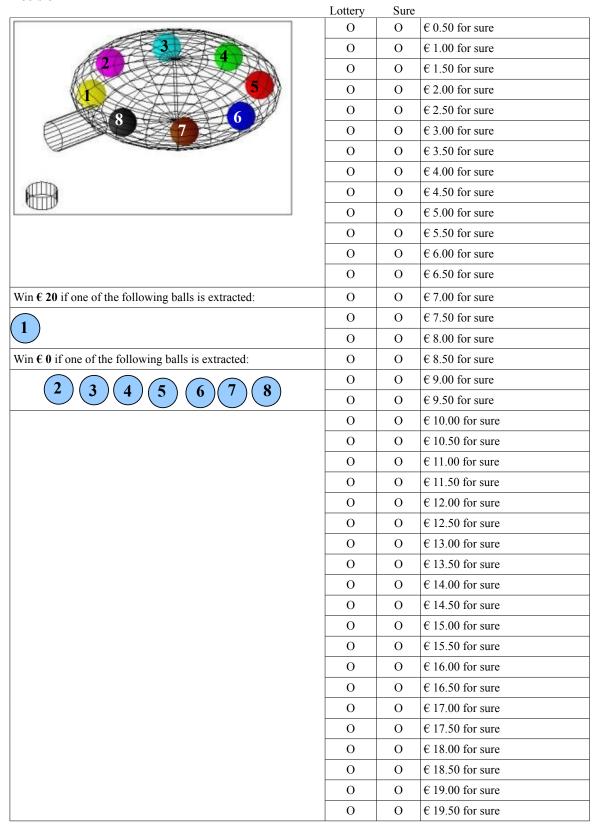


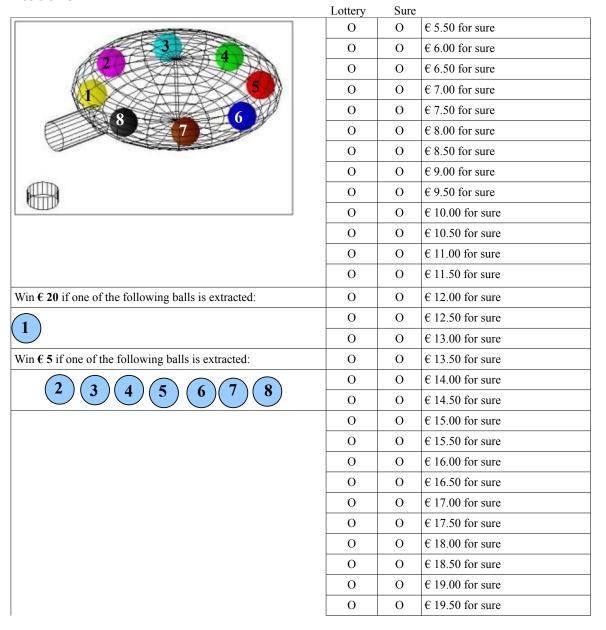


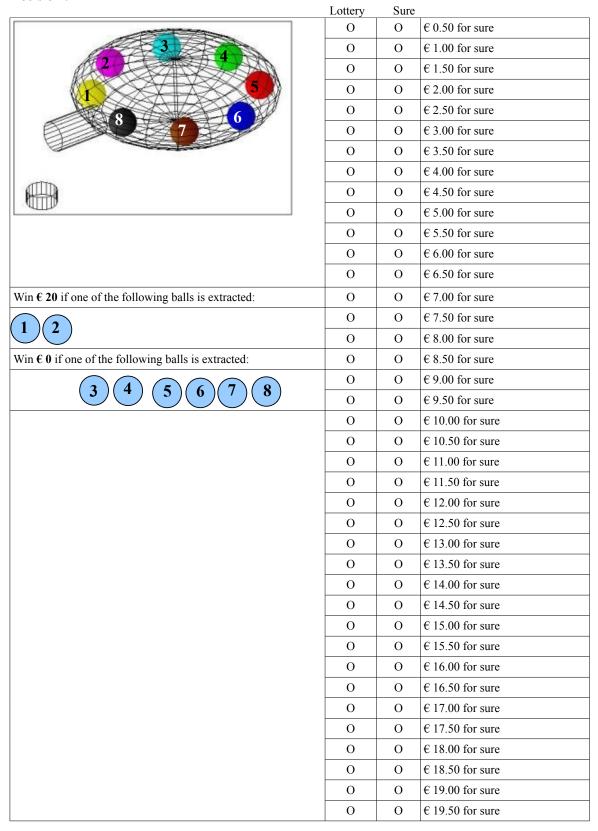


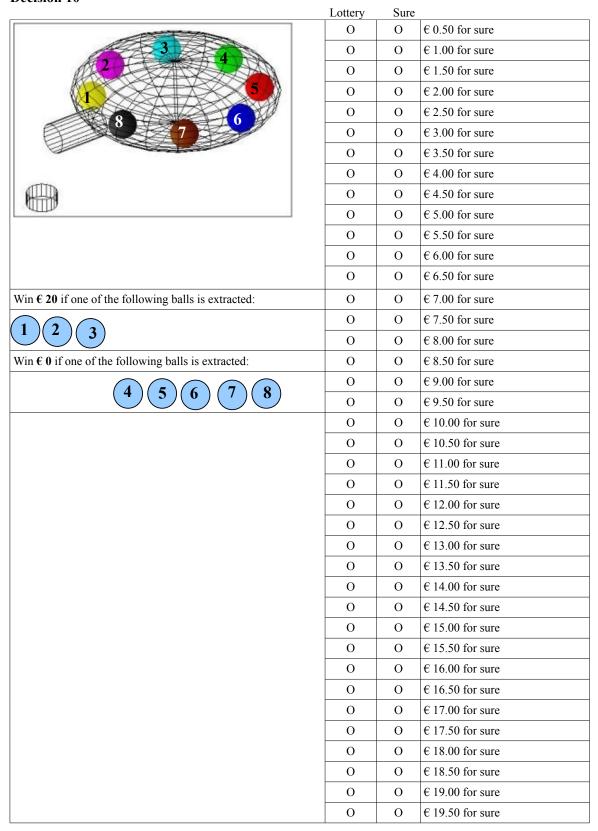


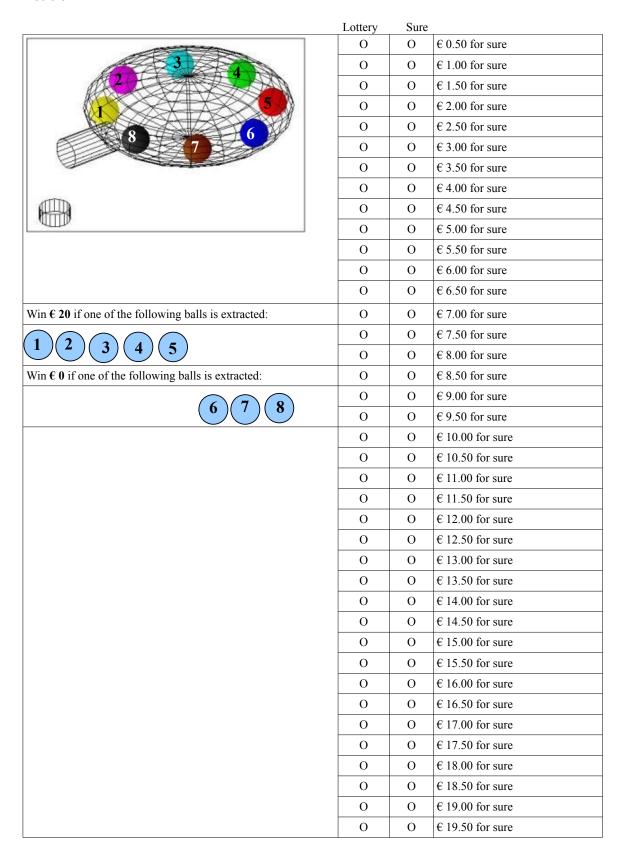


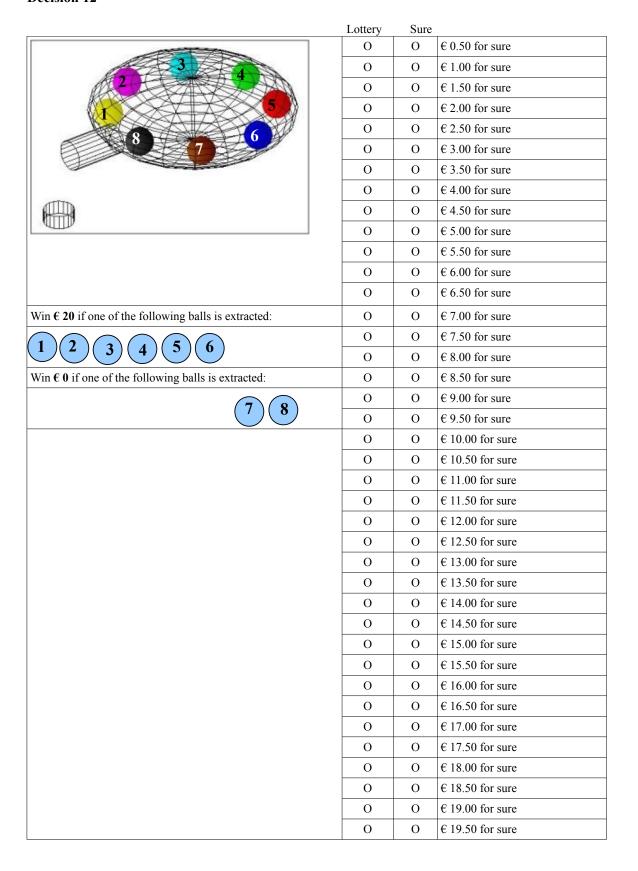


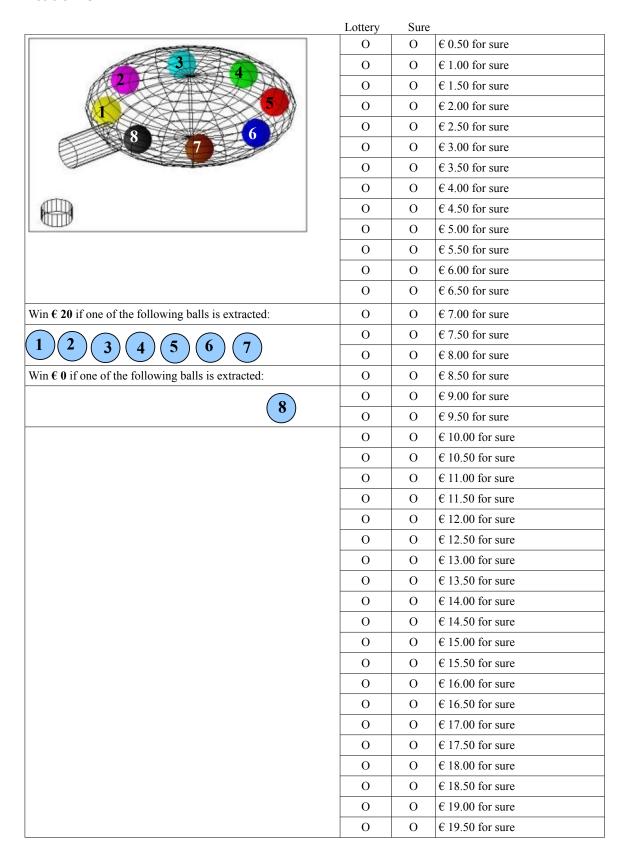


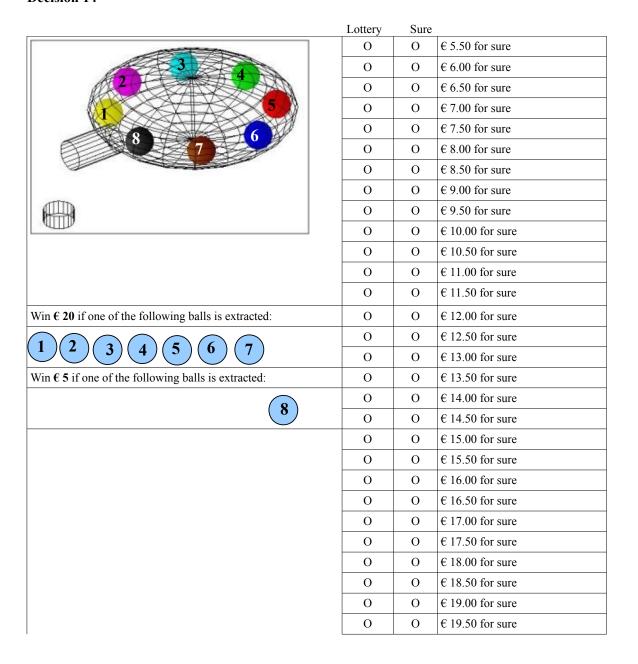


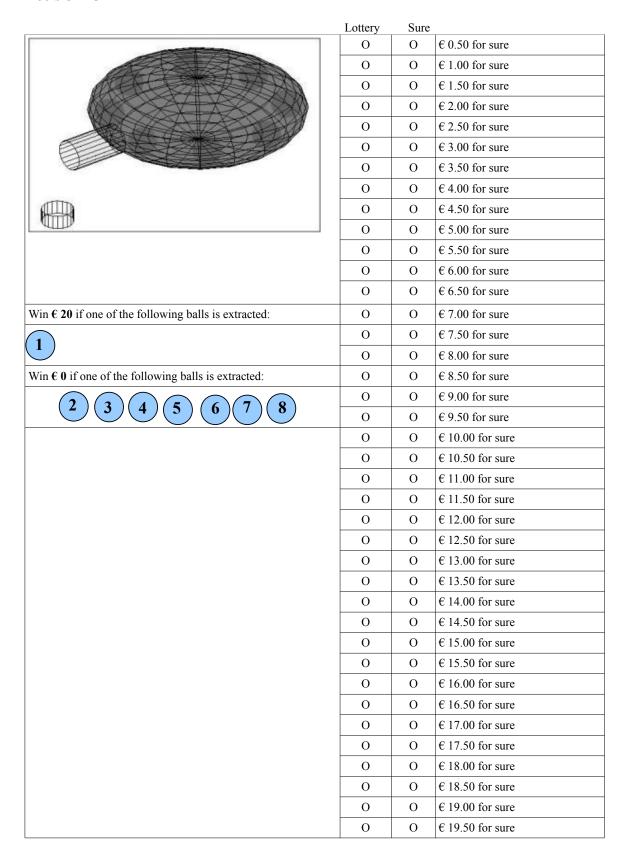


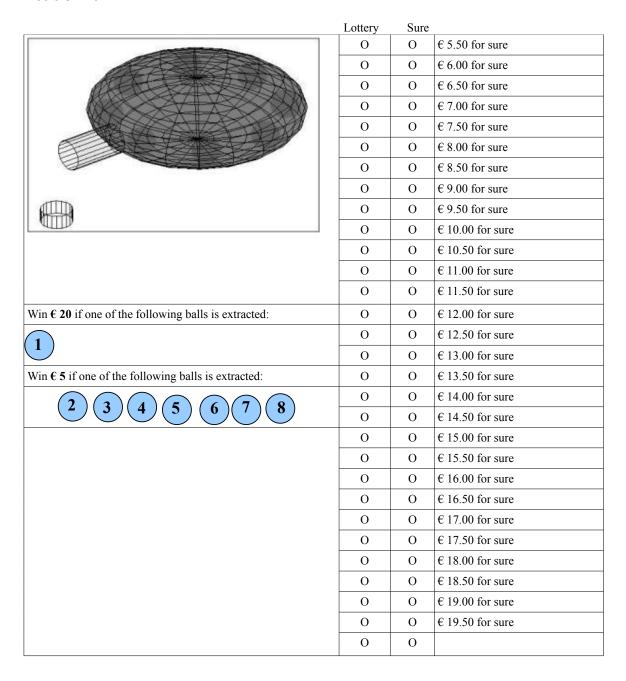


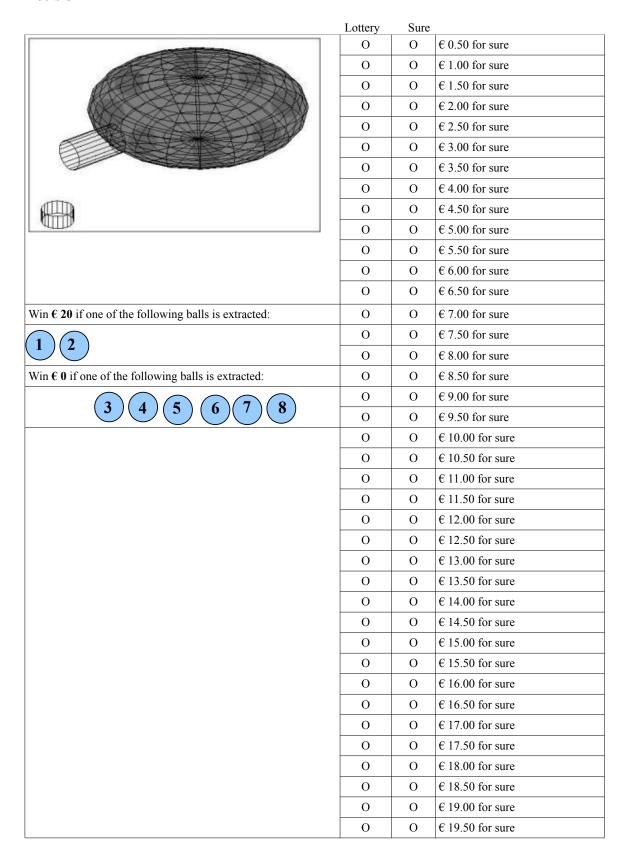


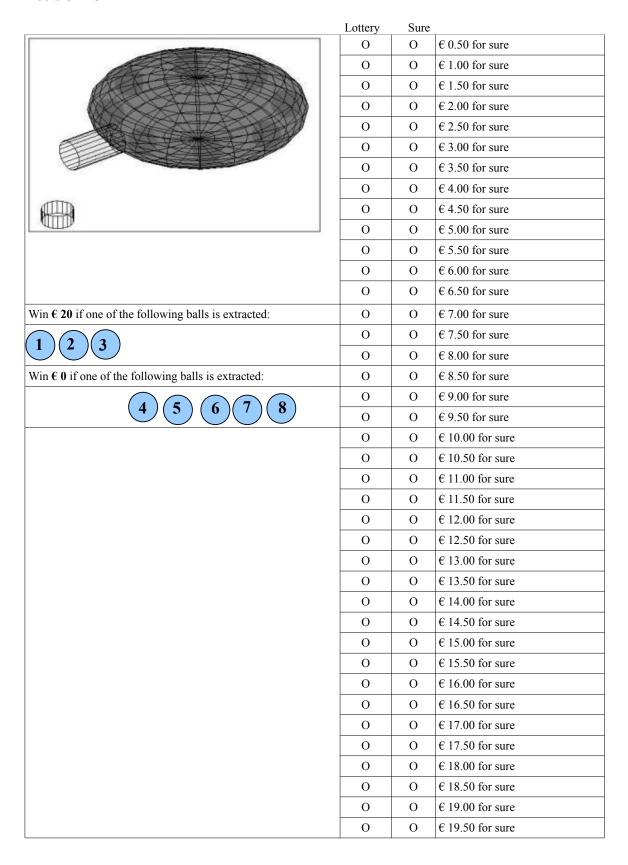


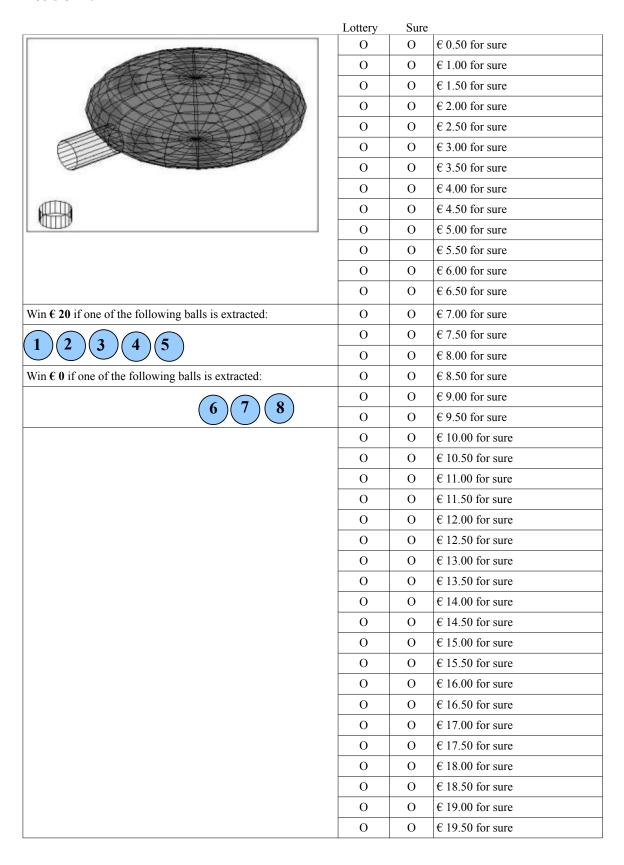


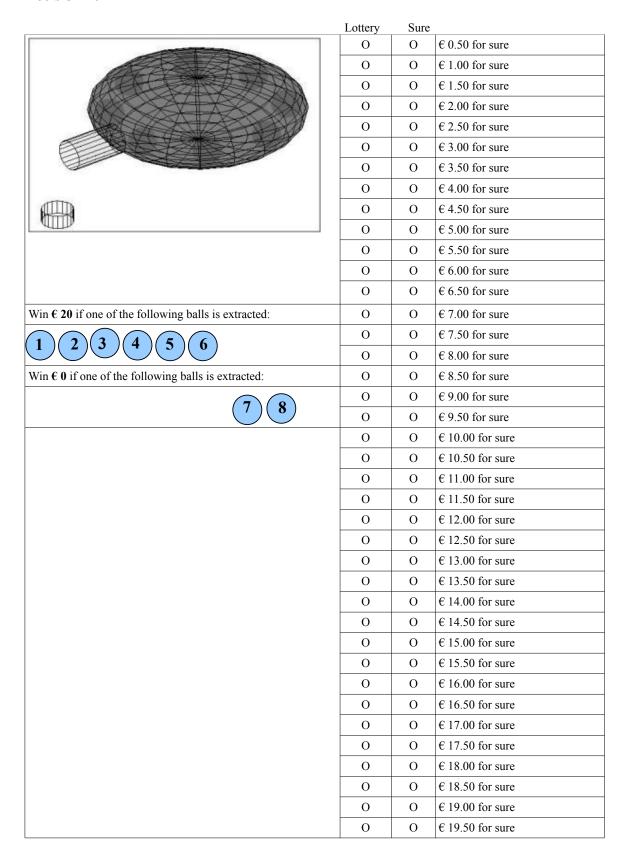




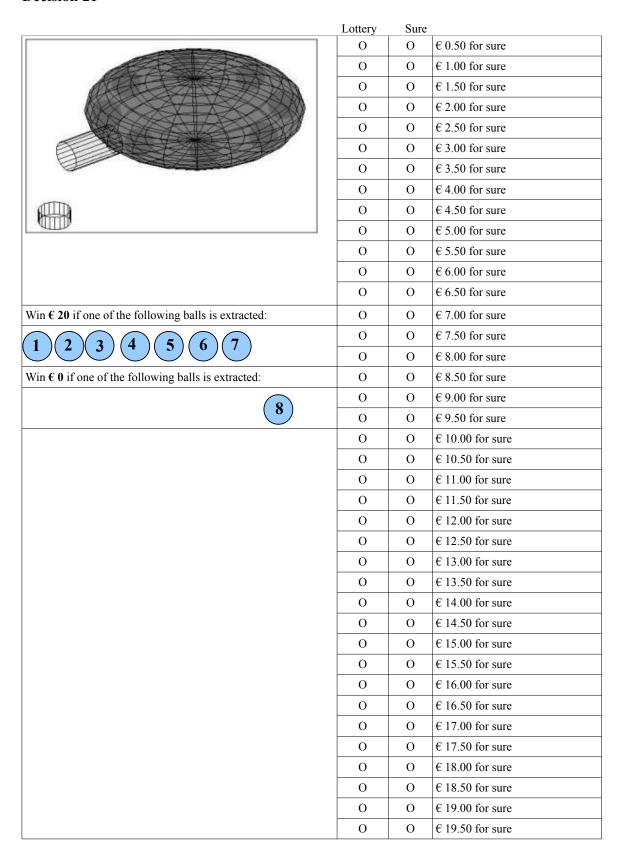




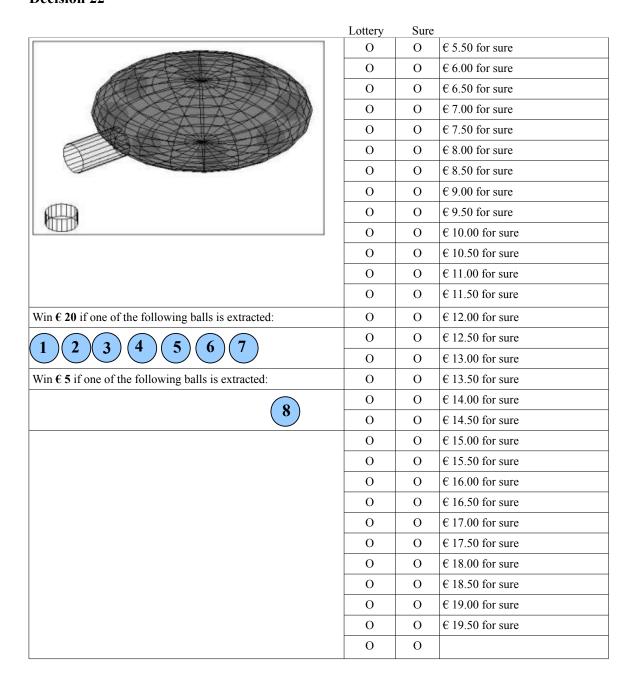




### **Decision 21**



### **Decision 22**



### **PART II**

If part II should be chosen for real play, you are endowed with €20. These €20 are yours, but it is possible that you will lose part or all of the money in the experiment (but no more than that).

In part II you are again asked to repeatedly choose between the two types of lotteries you have already encountered in part I of the experiment and a series of sure amounts. However, the main difference now is that **the amounts involved are negative instead of positive**. Figure 4 shows an example of such a choice.

Fig. 4: example of a typical decision task from part II

О	О	– € 0.50 for sure
О	О	– € 1.00 for sure
О	О	– € 1.50 for sure
О	О	– € 2.00 for sure
О	О	– € 2.50 for sure
О	О	– € 3.00 for sure
О	О	– € 3.50 for sure
О	О	– € 4.00 for sure
О	О	– € 4.50 for sure
О	О	– € 5.00 for sure
О	О	– € 5.50 for sure
О	О	– € 6.00 for sure
О	О	– € 6.50 for sure
О	О	– € 7.00 for sure
О	О	– € 7.50 for sure
О	О	– € 8.00 for sure
О	О	– € 8.50 for sure
О	О	– € 9.00 for sure
О	О	– € 9.50 for sure
	0 0 0 0 0 0 0 0 0 0 0 0 0	O O O O O O O O O O O O O O O O O O O

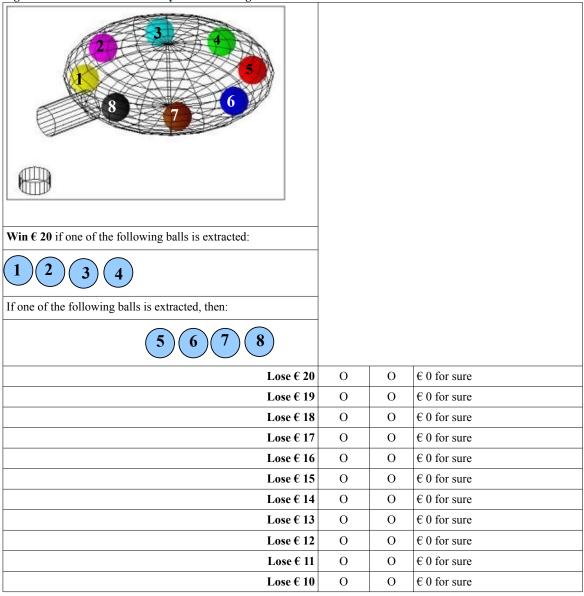
In the example displayed, you face the following lottery: if a ball with the number 1, 2, 3, or 4 is extracted, you lose  $\mathbf{e}\mathbf{10}$ . If a ball with the number 5, 6, 7, or 8 is extracted, you lose nothing. Please choose again for each row whether you would rather give up (i.e.,  $\underline{pay}$ ) the sure amount indicated to the right or play the lottery.

Notice that, most likely, you will now **begin to the right** by choosing to give up the sure amounts as long as this implies giving up small amounts, and then switch to the lottery at a certain point. If you do not want to give up sure amounts at all, then in the first row you can choose the lottery and then continue with the lottery for all choices (if you are not willing to pay  $\{0.50$  to avoid playing the lottery, then you should not be willing to pay  $\{1.00$  to avoid it). Once again, when exactly you switch from the sure loss to the lottery depends entirely on your preferences—there are no right or wrong answers. However, **you should NOT switch back and forth several times between lottery and sure amount!** You will be excluded from the experiment if you do so or if it is not possible to clearly recognize your preference (for example because you have not ticked any box for a given row or ticked both boxes for a row).

In addition to the pure loss choices described above, you will also face some choices in which both

**negative** <u>and</u> **positive** amounts are involved. Also, what changes is now not the sure amount to the right, which is always equal to zero, but rather the amount you can lose in the lottery. Figure 3 shows an example of this kind of choice problem.

Fig. 3: decision task where lottery amount changes

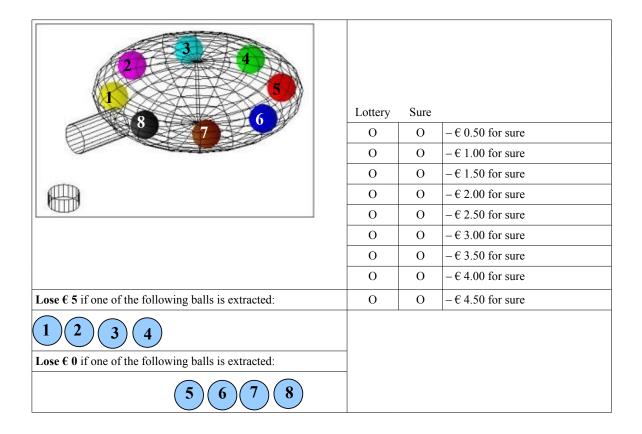


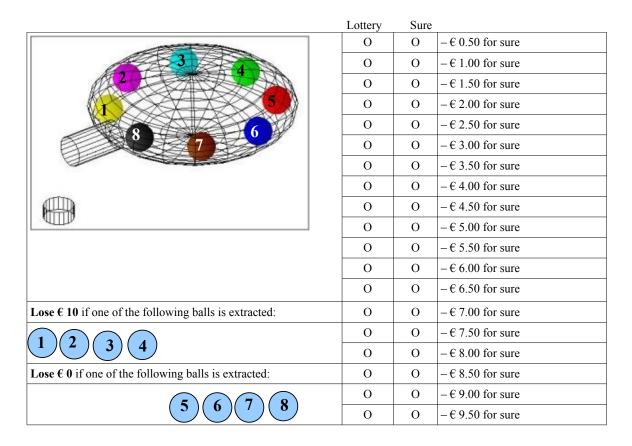
What is required of you in this task is exactly the same as for the other tasks. For each row, you should choose whether you prefer the sure amount to the right (which is now always zero), or the lottery to the left. Pay attention however: **what changes is now the amount that can be lost in the lottery**. Most likely, you would thus start from the right and choose zero for high losses, and then switch to the left as the losses in the lottery get smaller. You can however also start with the lottery and continue with it if that is your preference (if you prefer a lottery in which you can win  $\in$ 20 or lose  $\in$ 20 to zero, then you should also prefer the lottery when you can lose only  $\in$ 19). When you switch from the zero sure amount to the lottery depends only on your preferences—there is no right or wrong answer. However, **you should NOT switch back and forth several times between lottery and sure amount!** You will be excluded from the experiment if you do so or if it is not possible to clearly recognize your preference (for example because you have not ticked any box for

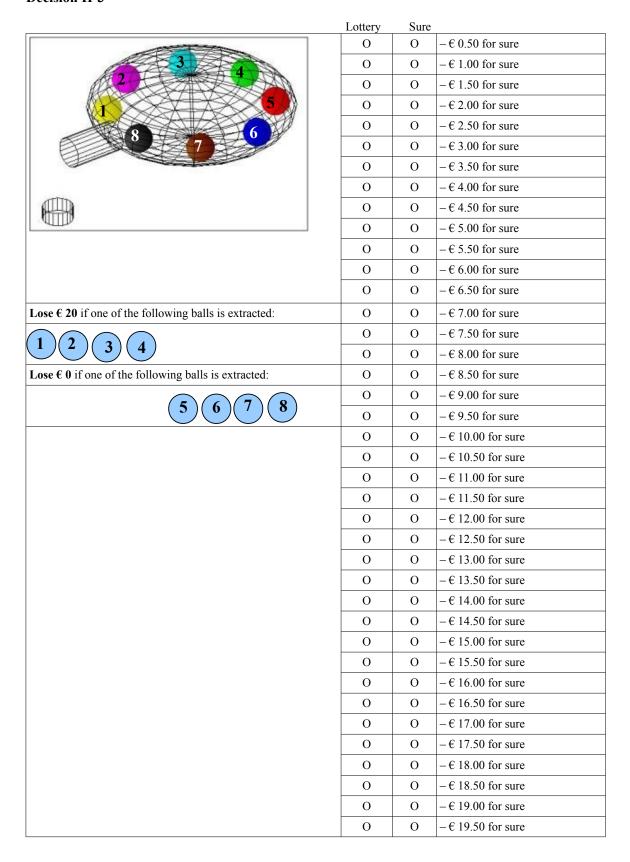
a given row or ticked both boxes for a row).

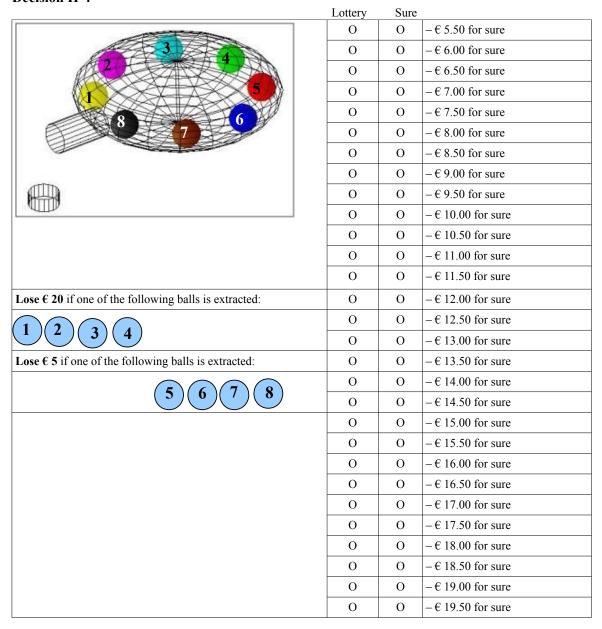
# **Payoff determination**

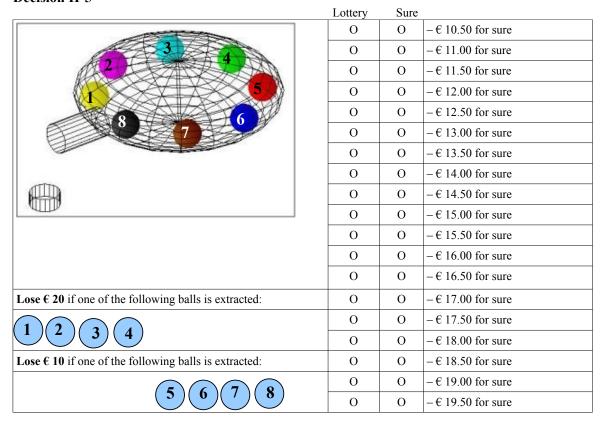
In case part II should be chosen for real play, your payoff from part II will be determined in a way analogous to the payoff determination in the first part. First, one of the decision tasks will be chosen at random, and then one of the rows for which you had to indicate a choice. In each case, **every choice task or row has an equal probability of being selected**. According to your choice, you are will then have to pay the sure amount, or the lottery will be played out by drawing a ball from the indicated urn.

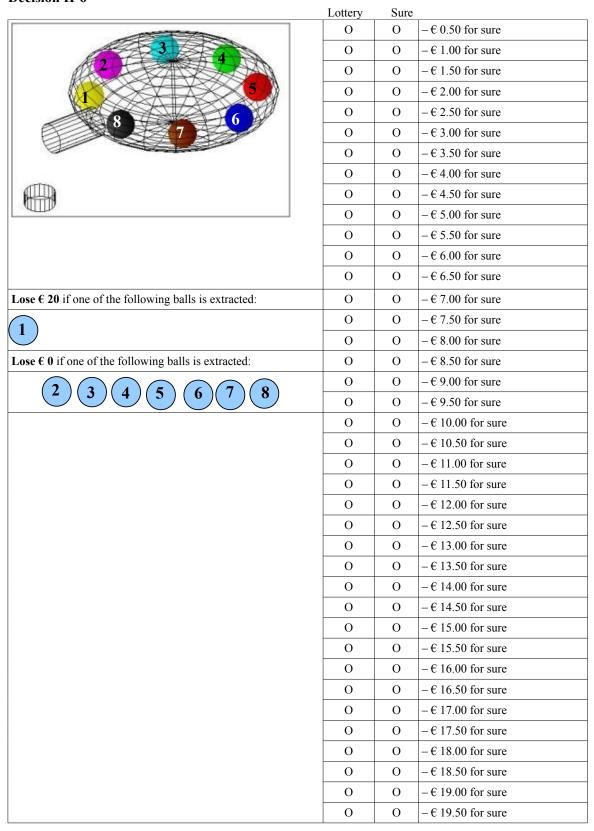




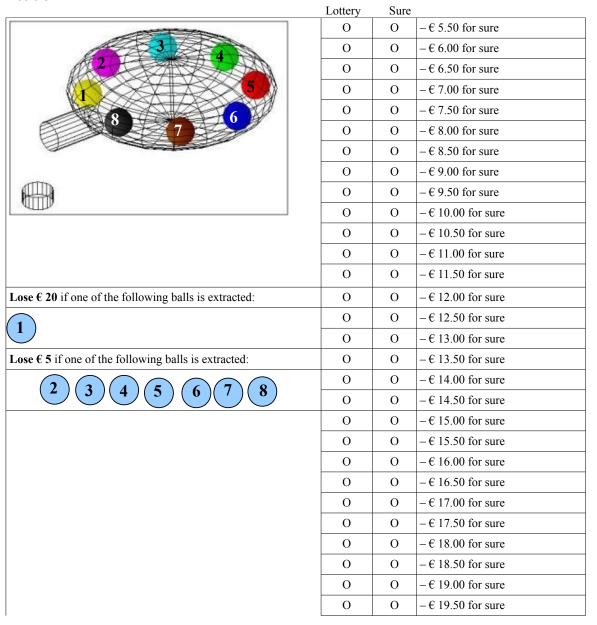


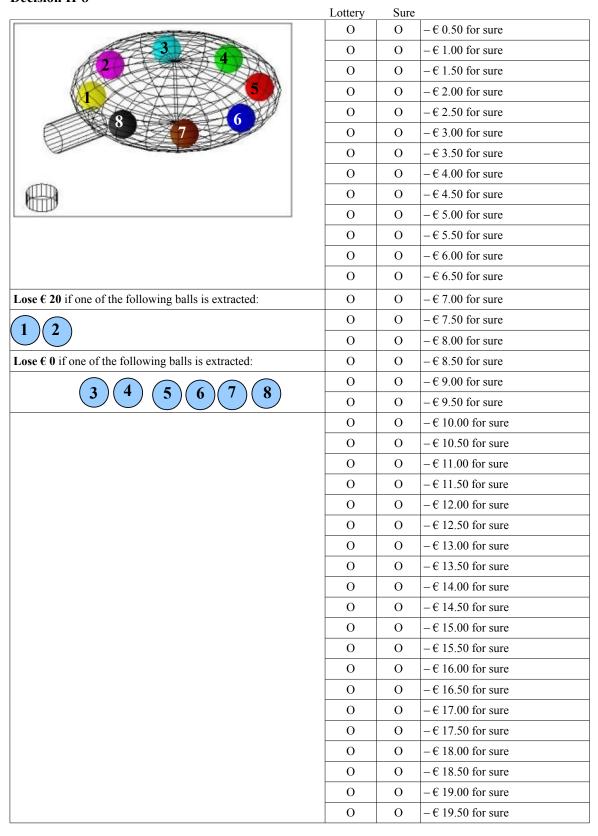


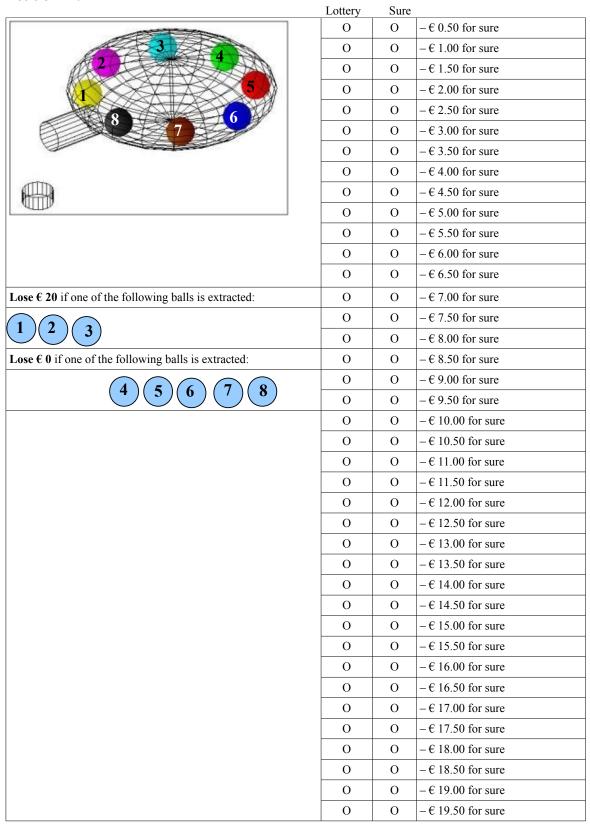


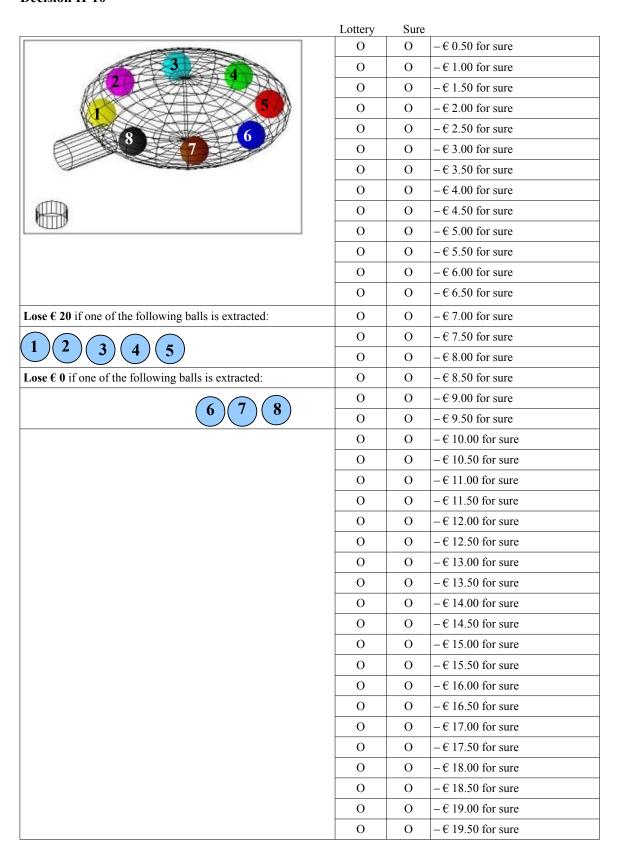


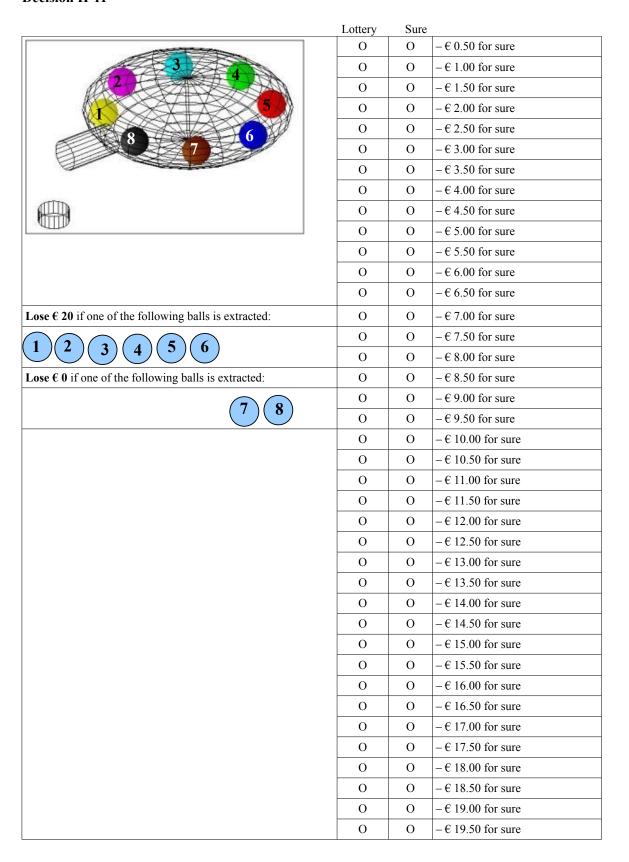
**Decision II-7** 



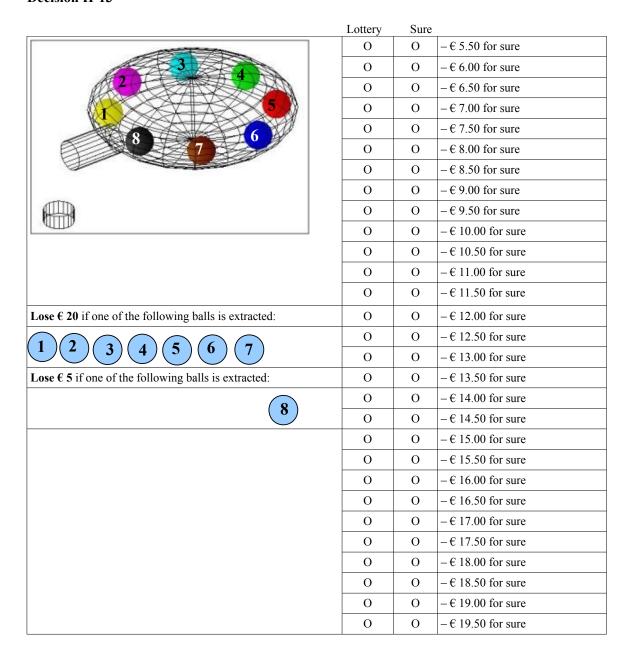


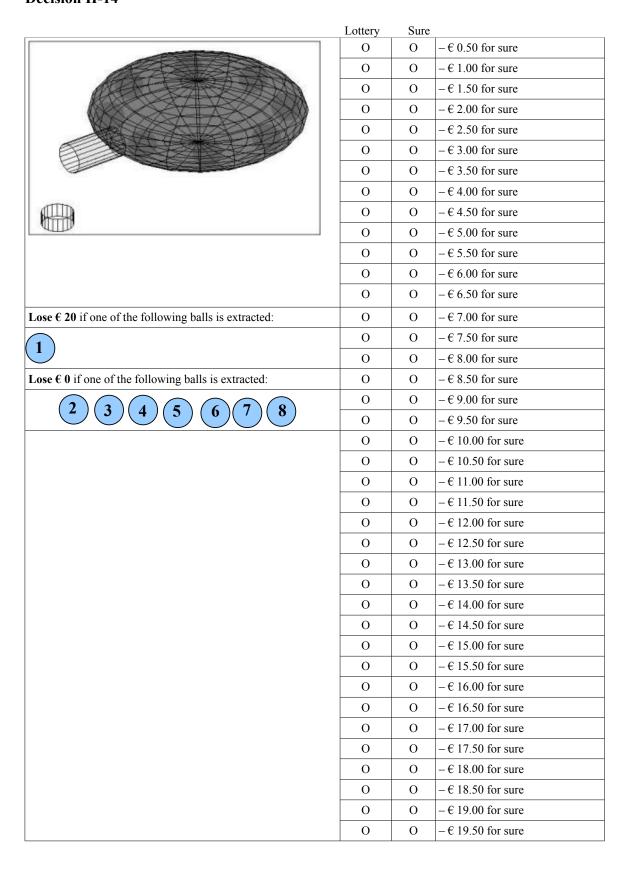


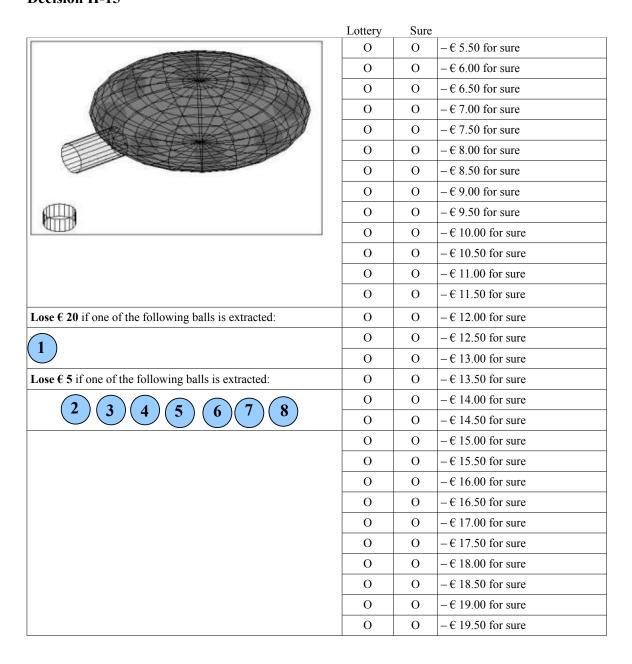


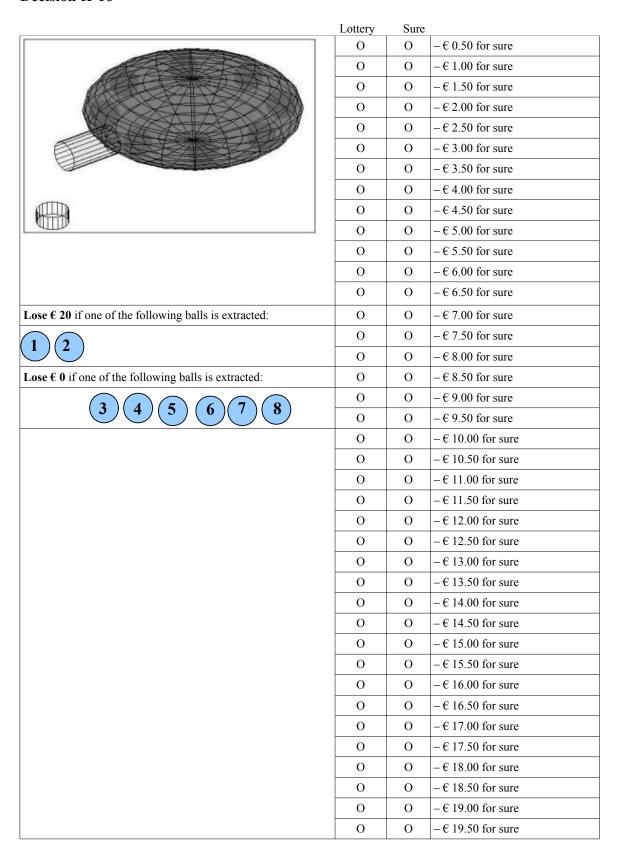


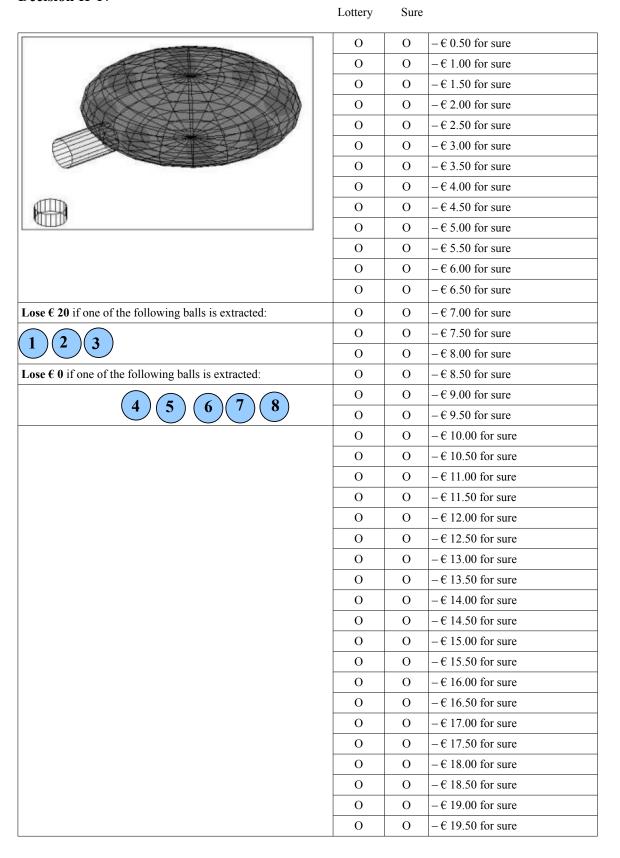
	Lottery	Sure	
	О	О	– € 0.50 for sure
3	О	О	– € 1.00 for sure
	О	О	– € 1.50 for sure
	О	О	– € 2.00 for sure
	О	О	– € 2.50 for sure
7	О	О	– € 3.00 for sure
	О	О	– € 3.50 for sure
	О	О	– € 4.00 for sure
	О	О	– € 4.50 for sure
	О	О	– € 5.00 for sure
	О	О	– € 5.50 for sure
	О	О	– € 6.00 for sure
	О	О	– € 6.50 for sure
Lose € 20 if one of the following balls is extracted:	О	О	– € 7.00 for sure
1 2 3 4 5 6 7	О	О	– € 7.50 for sure
(1)(2)(3)(4)(5)(6)(7)	О	О	– € 8.00 for sure
<b>Lose € 0</b> if one of the following balls is extracted:	О	О	– € 8.50 for sure
	О	О	– € 9.00 for sure
8	О	О	– € 9.50 for sure
	О	О	– € 10.00 for sure
	О	О	– € 10.50 for sure
	О	О	– € 11.00 for sure
	О	О	– € 11.50 for sure
	О	О	– € 12.00 for sure
	О	О	– € 12.50 for sure
	О	О	– € 13.00 for sure
	О	О	– € 13.50 for sure
	О	О	– € 14.00 for sure
	О	О	– € 14.50 for sure
	О	О	– € 15.00 for sure
	О	О	– € 15.50 for sure
	О	О	– € 16.00 for sure
	О	О	– € 16.50 for sure
	О	О	– € 17.00 for sure
	О	О	– € 17.50 for sure
	О	О	– € 18.00 for sure
	О	О	– € 18.50 for sure
	О	О	– € 19.00 for sure
	О	О	– € 19.50 for sure

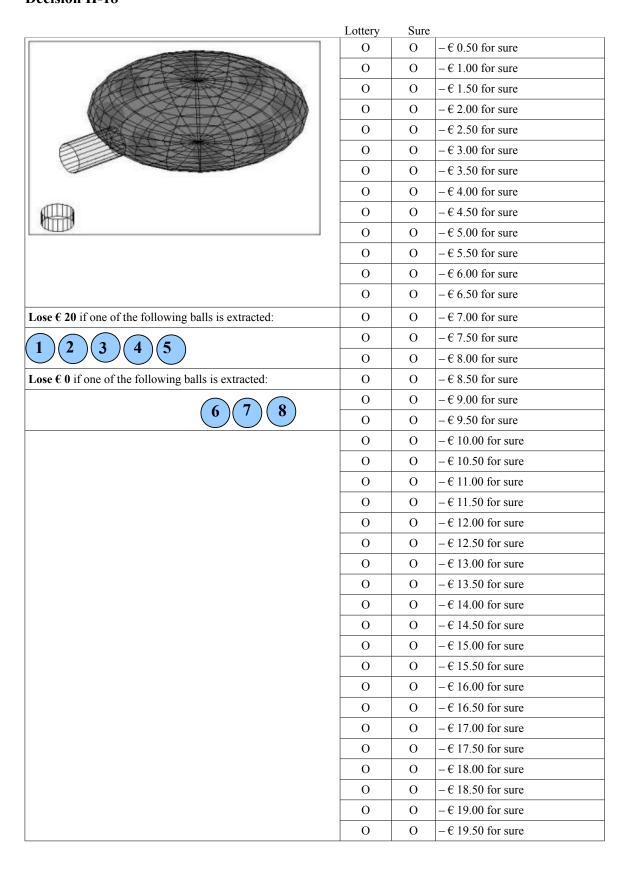


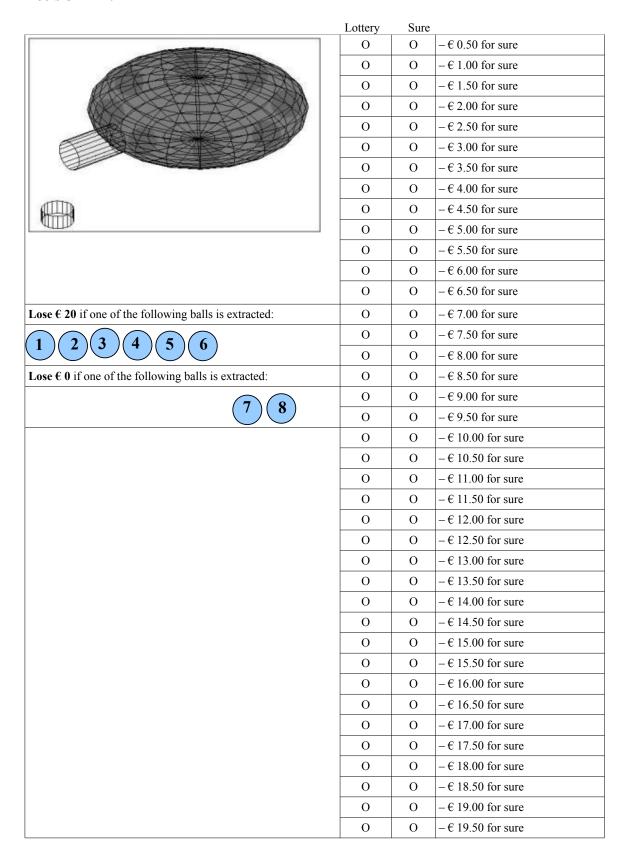


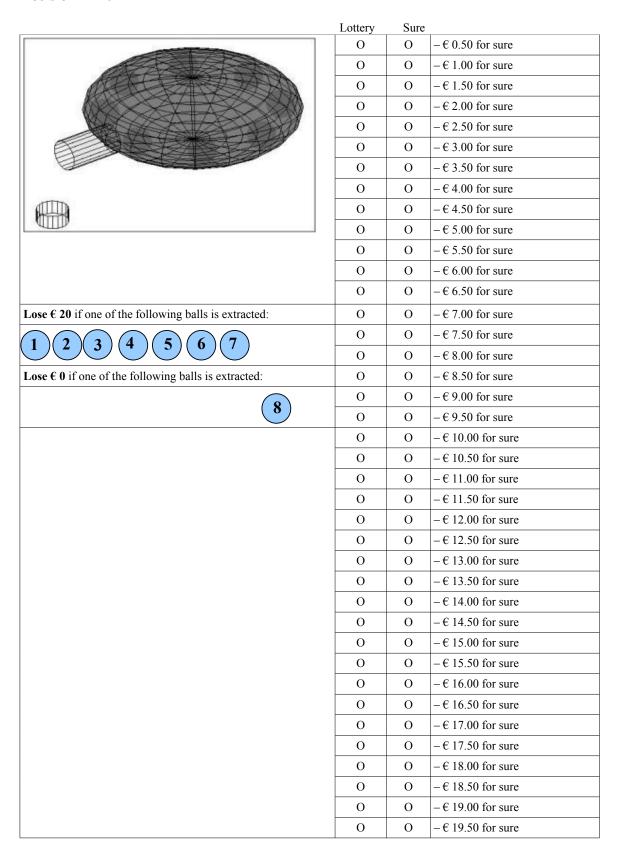


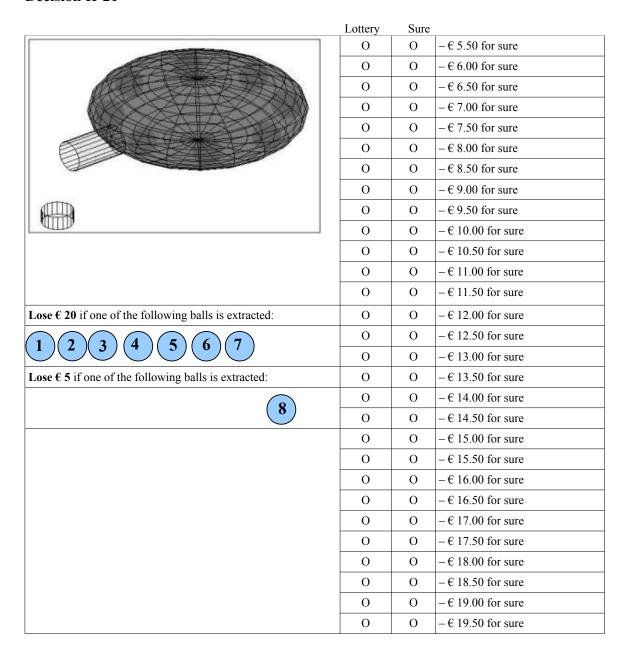




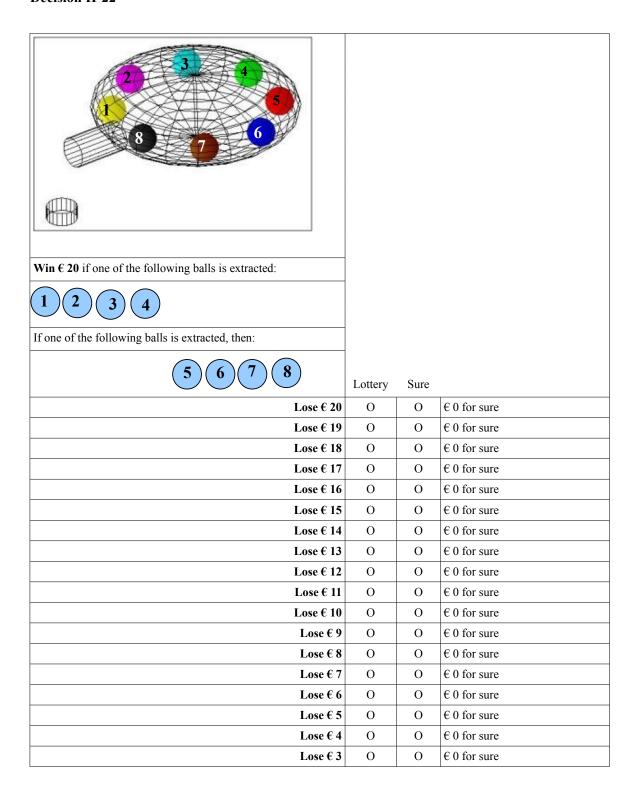








**Decision II-22** 



# Questionnaire

personally.	following questi	ons about yourse	eii. Ali answers ai	re confidential and	cannot be traced	a back to you
Age:	_ Study se	emester:				
O female	O male					
What is your stud O economics or b O mathematics or O natural sciences O medicine O social sciences O humanities O arts O other	usiness engineering					
Please indicate yo	our grade point av	verage:				
Are you originally	y from \$\$name or	f country where	exp. is to take pla	ce\$\$? O yes	O no	
If not, which cour	ntry are you from	originally?		_		
Are both your par	ents from \$\$nam	e of country who	ere exp. is to take	place\$\$? O yes	O no	
Have you ever liv O never O less than six mo O between six mo O between one an O between two an O longer than five Could you give a Could you give a Please indicate ho Please indicate ho Are you married? How tall are you?	onths onths and a year d two years d five years e years rough indication rough indication ow many older sil ow many younger O yes O	of your monthly of your monthly plings you have: siblings you have	living expenses? stipend?			
now tall are you.		1				
	dicate on the scal	e below the exter		nge is a serious dan gree with this state		
1	2	3	4	5	6	7
О	O	O	O	О	О	О
consequences from	n changes in glol	bal climate, even	if such action ma	mediate action to lay be costly". Pleason't agree at all" ar	se indicate on th	e scale below th
1	2	3	4	5	6	7
О	О	O	О	О	О	O

The following section seeks to evaluate your cultural orientation. Please indicate your agreement with each of the following statements:

	Stongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Individuals should sacrifice self-interest for the group that they belong to	О	О	О	О	О
2. Individuals should stick with the group even through difficulties	О	О	0	О	О
3. Group welfare is more important than individual rewards	О	О	0	О	О
4. Group success is more important than individual success	О	О	О	О	О
5. Individuals should pursue their goals after considering the welfare of the group	О	О	0	О	О
6. Group loyalty should be encouraged even if individual goals suffer	О	О	0	О	О
7. People in higher positions should make most decisions without consulting people in lower positions	О	О	О	0	О
8. People in higher positions should not delegate important tasks to people in lower positions	О	О	О	0	О
9. People in higher positions should not ask the opinions of people in lower positions too frequently	О	О	О	О	О
10. People ion higher positions should avoid social interaction with people in lower positions	О	О	О	О	О
11. People in lower positions should not disagree with decisions made by people in higher positions	О	О	О	О	О
12. It is important to have instructions spelled out in detail so that I always know what I am expected to do	O	О	О	О	O
13. It is important to closely follow instructions and procedures	О	О	0	О	О
14. Rules/regulations are important because they inform me of what is expected of me	О	О	О	0	О
15. Standardized work procedures are helpful	О	О	0	О	О
16. Instructions for operations are important	О	О	О	О	О
17. It is more important for men to have a professional career than it is for women	О	О	0	О	О
18. Men usually solve problems with logical analysis; women usually solve problems with intuition	О	О	О	0	О
19. Solving difficult problems usually requires an active forcible approach, which is typical for men	О	О	О	О	О
20. There are some jobs that a man can always do better than a woman	О	О	О	О	О
21. Even though certain food products are available in a number of different flavors, I tend to buy the same flavor	О	О	О	0	О
22. I would rather stick with a brand I usually buy than try something I am not very sure of	O	O	О	О	O
23. I think of myself as a brand-loyal consumer	О	О	О	О	О
24. When I go to a restaurant, I feel it is safer to order dishes I am familiar with	О	О	О	О	О
25. If I like a brand, I rarely switch from it just to try something different	О	О	О	О	О
26. I am very cautious in trying new or different products	О	О	О	О	О
27. I rarely buy brands about which I am uncertain how they will perform	О	О	О	О	О
28. I usually eat the same kinds of foods on a regular basis	О	О	О	О	О

How do you see yourself? Are you generally a person who is fully willing to take risks or do you try to avoid taking risks? Please tick a box on the scale below, where 0 means "risk averse" and 10 means "fully prepared to take risks":

Risk averse										prepared to take risks
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

People can behave differently in different situations. How would you rate your willingness to take risks in the following areas? How is it ...

fully prepared

r	isk avers	e								to ta	ke risks
	0	1	2	3	4	5	6	7	8	9	10
- while driving?	О	О	О	О	О	О	О	О	О	О	О
- in financial matters?	О	О	О	О	О	О	О	О	О	О	О
- during leisure and sport?	О	О	О	О	О	О	О	О	О	О	О
- in your occupation?	О	О	О	О	О	О	О	О	О	О	О
- with your health?	О	О	О	О	О	О	О	О	О	О	О
– your faith in other people?	О	О	О	О	О	О	О	О	О	О	О

Please consider what you would do in the following situation:

Imagine that you had won 100,000 Euros in the lottery. Almost immediately after you collect the winnings, you receive the following financial offer from a reputable bank, the conditions of which are as follows:

There is the chance to double the money within two years. It is equally possible that you could lose half of the amount invested. You have the opportunity to invest the full amount, part of the amount or reject the offer. What share of your lottery winnings would you be prepared to invest in this financially risky, yet lucrative investment?

O	100.000 Euros
O	80.000 Euros
O	60.000 Euros
O	40.000 Euros
O	20.000 Euros
O	Nothing I would decline the offer

How many inhabitants has the town where you lived at the age of 16?
inhabitants
What are your religious views?
O atheist/agnostic
O catholic
O protestant
O muslim
O jewish
O hinduist
O buddist
O other:

Thank you for taking part in this experiment! Please remain seated until an experimenter calls you up.

# References

Abdellaoui, Mohammed, Aurélien Baillon, Lætitia Placido, and Peter P. Wakker (2011)

'The Rich Domain of Uncertainty: Source Functions and Their Experimental Implementation.' American Economic Review 101, 695–723

Dimmock, Stephen G, Roy Kouwenberg, Olivia S Mitchell, and Kim Peijnenburg (2015) 'Estimating ambiguity preferences and perceptions in multiple prior models: Evidence from the field.' *Journal of risk and uncertainty* 51(3), 219–244