Online Appendix to "Making the Anscombe-Aumann Approach to Ambiguity Suited for Descriptive Applications"

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This appendix gives details about the experiment presented in §3.

Design & Laboratory Details

The experiment was run at the CentERlab at Tilburg University, using z-tree software (Fischbacher, U., 2007, Z-Tree: Zurich Toolbox for Ready-Made Economics Experiments, *Experimental Economics*, 10, 171–178.). The experiment consisted of two parts. General instructions on paper were provided at the beginning of the experiment, and specific instructions were given to subjects before each part. Additional information about the prospects and the choice situations was given on the screens. An example of a screen shot is given below. The complete instructions are included below.

In Part 1, subjects made choices in three choice lists with each 11 choices between two prospects, to elicit their utility as described in the main paper. In these choice lists, the right hand side prospect remained constant across choices, while the left hand side prospect monotonically improved when going down the list (see example list in the instructions below). We enforced monotonicity, i.e., subjects could switch from the right hand side to the left hand side at most once. This was done because we needed to immediately calculate individual certainty equivalents to be used in Part 2 of the experiment. All probabilities were known in Part 1, and were described (and actually played) in terms of colored chips drawn from a bag. We used frequency, percentage, and graphical illustrations to present the prospects, as illustrated in the instructions below.

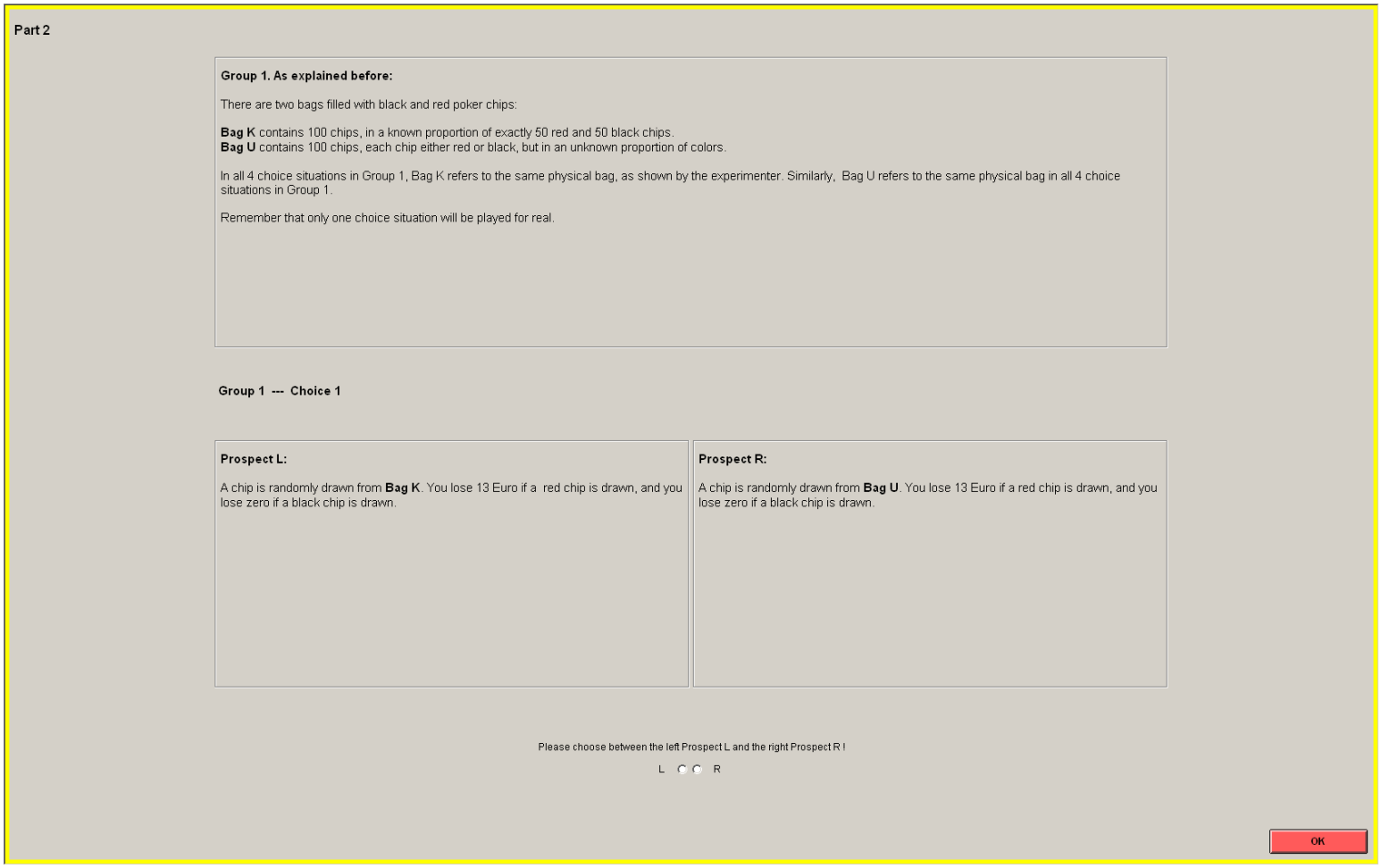
In Part 2 of the experiment, subjects made choices between two prospects based on chips drawn from a ("known") bag with exactly 50 red and 50 black chips, and an ("unknown") bag with 100 chips, either red or black, but in unknown proportion. For example, subjects choose between winning a prize if red is drawn from the known bag or winning the prize if red is drawn from the unknown bag (see screen shot below). Subjects made choices with red the winning color as well as choices with black the winning color, to prevent suspicion. The prizes varied across subjects and depended on the certainty equivalents elicited in Part 1.

45 students participated in 5 sessions. All subjects received €3 show up fee. After all subjects had made their decisions in both parts, for each subjects one part and one decision in that part were selected randomly to determine the potential payoff from the experiment. This payoff could be negative because there were mixed prospects. All randomizations of prospects were conducted using bags filled with colored chips. One subject was selected randomly by the computer to assist with drawing chips form the bags. The results were entered into the computer and were used by the program to calculate payoffs for all subjects.

After the potential payoffs were determined and shown to the subjects, each subject threw a 4-sided die: with a probability of 25% the subject would receive an additional €20, *and* her potential payoff. With a probability of 75%, the subject would receive neither the additional payoffs nor her potential payoffs, and would leave the lab with only the show up fee. This procedure was chosen to be able to provide significant gains and losses in the experiment. The sessions took about 40 minutes, and the average earnings were €7.48.

Our measurement was chained because $U^{-1}(100)$ was used as input in a later question. If subjects are aware of this chaining then they can exploit it (Harrison 1986). It is highly unlikely that the subjects realized that the lottery outcome $U^{-1}(100)$ necessarily was the midpoint between the two numbers where they had switched preference before, and it is impossible that they anticipated this chained nature of our experiment.

Screenshot part 2



Additional references

Harrison, Glenn W. (1986) "An Experimental Test for Risk Aversion," *Economic Letters* 21, 7–11.

General Instructions

This is an experiment about decision making. If you follow these instructions carefully and make thoughtful decisions then you can earn a considerable amount of money.

Payment

You have already received your show-up payment of €3.

For the additional payoffs from the experiment we will use the following procedure: depending on his/her choices and chance events as described below, for each participant the "potential" payoff from the experiment will be determined. This payoff can be positive and substantial, or moderately negative. At the end of the experiment we select one of every four participants for real play. For the subjects not selected the game is over. If you are selected for real play, then you first receive a flat payment of €20, your second payment (the first was the showup payment). Then your third payment is the potential payoff obtained during the experiment, which is added to what you have if positive, but subtracted from what you have if negative (if negative it never exceeds €20, so that you can pay it from the money received before and you never leave the lab poorer than you entered). To summarize, earnings can be significant in this experiment. One of every four participants receives more than the showup fee, and then has an expected payoff of about €30.

Structure of the Experiment

The experiment consists of two parts. In both parts you will make choices between risky payoff distributions that we call *prospects*. In each choice situation you choose between a left prospect (L) and a right prospect (R). The risky payoffs of these prospects will be determined by actually drawing colored poker chips from various bags filled with such chips. In particular, there are five bags, Bag 1, Bag 2, Bag 3, Bag K, and Bag U, as shown by the experimenter. These five bags have been assembled as explained later, and will be used at the end of the experiment to draw chips.

You will make choices between different risky prospects in two parts of the experiment. After all choices have been made, for each participant the computer randomly selects one part first, and then randomly selects one choice situation from this part to determine the potential payoff (see description under "Payment"). Your potential payoff depends on the selected choice situation, the choice that you made in this situation, and the outcome of the risky prospect (determined by the chip drawn from the relevant bag).

Because of the random selection of one choice situation for real play, each choice situation may be the one that you will play for real. Therefore, in each situation please choose what you yourself prefer most there, because this is what you will want to happen if this situation is later played for real. In this experiment there are no right or wrong answers; please choose what you yourself prefer most according to your own feelings in each situation. The latter, what you yourself prefer most, is what we are interested in and what we want to investigate.

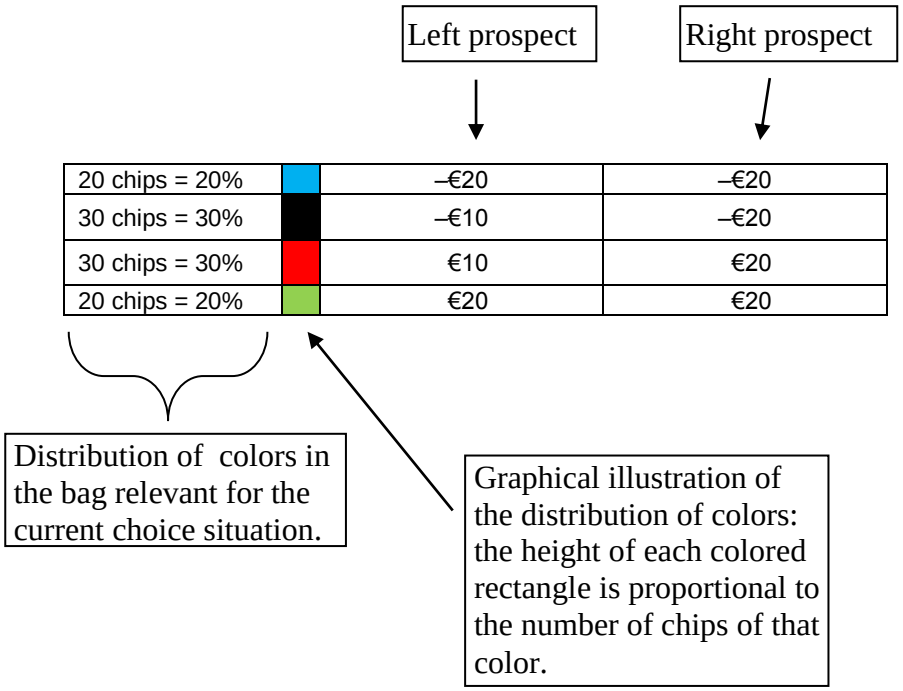
After all participants have made all their choices, the experimenter will ask one randomly selected participant to publicly draw the chips from the bags.

Please raise your hand if you have any questions about the general structure of the experiment.

Instructions for Part 1

Choices

In each choice situation in part 1, you make a choice between a left prospect and a right prospect, whose payoffs depend on the color drawn from a bag filled with colored poker chips. In each choice situation, the left and the right prospect depend on the same drawing from the same bag. A typical choice situation is shown in the following figure:



In this example, if you choose the left prospect, then you lose €20 if a blue chip is drawn (20% chance), you lose €10 if a black chip is drawn (30% chance), you win €10 if a red chip is drawn (30% chance), and you win €20 if a green chip is drawn (20%). The payoffs for the right prospect are analogously defined relative to the four colors.

In the example you see that making a choice between the left prospect and the right prospect comes down to comparing their advantages per color: If a black chip is drawn the right prospect leads to a larger loss of €20 compared to the left prospect. On the other hand, if a red chip is drawn, the right prospect leads to a higher gain of €20 compared to only €10 for the left prospect. Both prospects have the same payoff if a blue or if a green chip is drawn.

In the choice situations in Part 1, one prospect will usually be better than the other prospect for some colors and worse for some other colors. Your choice will concern not only the payoffs, but also the probabilities with which they occur.

All choices in Part 1 involve prospects with payoffs depending on the four different colors. As in the example, left and right prospects will always have identical payoffs in the case a blue chip is drawn and in the case a green chip is drawn (see the top and the bottom row of each choice situation).

Lists

The choice situations in Part 1 are organized in lists of 11 choices each. On the following page is an example list that we explain in detail.

For each choice you have to make a decision as described above. As you can see in the example list, by going down the list the choice situations vary systematically. In the example, the payoff for the right-hand prospect for the case of a red chip drawn increases when going down the list. That is, the right-hand option becomes more attractive when going down the list. The left prospect remains unaltered.

In the actual lists in the experiment, always only the right-hand option will change at exactly one color, and the right-hand option becomes more attractive when going down the list. For this reason we restrict your choices in each list such that when you go down the list, you can only switch from choosing left prospects to choosing right prospects, and not the other way around. That is, if in the example list on the next page you choose left in "Choice 1" and right in "Choice 2", then you cannot choose left in any of the other choices 3,4 ,..,11. This makes sense because once right is chosen, in all lower choice situations the right-hand prospect has only become more preferable.

For each list, a different bag with chips will be relevant. It will be assembled as shown in the choice figures and will also be described verbally on the screen.

Please raise your hand if you have any questions about Part 1 of the experiment.

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€20
20 chips = 20%		€20	€20

Choice 1 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€21
20 chips = 20%		€20	€20

Choice 2 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€22
20 chips = 20%		€20	€20

Choice 3 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€23
20 chips = 20%		€20	€20

Choice 4 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€24
20 chips = 20%		€20	€20

Choice 5 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€25
20 chips = 20%		€20	€20

Choice 6 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€26
20 chips = 20%		€20	€20

Choice 7 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€27
20 chips = 20%		€20	€20

Choice 8 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€28
20 chips = 20%		€20	€20

Choice 9 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€29
20 chips = 20%		€20	€20

Choice 10 ➔ left O O right

20 chips = 20%		–€20	–€20
30 chips = 30%		–€10	–€20
30 chips = 30%		€10	€30
20 chips = 20%		€20	€20

Choice 11 ➔ left O O right

Instructions for Part 2 <receive handout after finished part 1>

In part 2 you make choices between prospects whose payoffs are uncertain and depend on the outcome of colored poker chips drawn from either of two bags. The following two bags filled with red and black chips will be used:

Bag K contains 100 chips, in a known proportion of exactly 50 red and 50 black chips.

Bag U contains 100 chips, each chip either red or black, but in an unknown proportion of colors.

In part 2 you will make, in total, eight choices between prospects. Prospects may involve payoffs that depend on either Bag K or Bag U, they may involve either gains or losses, and the winning (losing) color can be either red or black. A typical choice situation may be as follows:

Prospect L:	Prospect R:
A chip is randomly drawn from Bag K. You win €1 if a red chip is drawn and you lose €1 if a black chip is drawn.	A chip is randomly drawn from Bag K. You win €5 if a red chip is drawn and you lose €5 if a black chip is drawn.

You will have to decide whether you want to play prospect L(eft) or prospect R(ight). In the experiment, for each choice situation where red is the favorable color, there follows another choice situation that is the same and relates to the same bag but now black is the favorable color.

The eight choice situations in Part 2 are grouped into two groups. Group 1 involves 4 choices between prospects and Group 2 also involves 4 choices between prospects. Detailed information about the groups and which bags K and U are relevant in each case are given on the screen.

Please raise your hand if you have any questions about Part 2 of the experiment.