The Nature of Experience Project*
– Study Plan –

Karlijn van den Broek[1,2], Florian Diekert[2,3], Timo Goeschl[2], Christian König-Kersting[2], and Viktoria von Waldenfels[2]

[1]Department of Psychology, Heidelberg University
[2]Alfred Weber Institute for Economics, Heidelberg University
[3]CEES, University of Oslo

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This document presents the research design for the Nature of Experience Project. This description should serve to help readers understand the context and the motivation for specific design choices, the hypotheses to be tested, as well as the planned implementation of the experiment, while maintaining flexibility with regards to the publication strategy of the eventual findings.

1 Research Question

Both strategic and natural uncertainty (risk) determine whether agents receive an economic reward in many environments. Moreover, many environments require repeated decisions. When periods are stochastically independent, do agents respond to an adverse outcome? And does it matter for their response whether the strategic or the natural risk materialized to cause the event?

We design an experimental choice situation that contains both strategic and natural uncertainty and repeat the situation once, after feedback on first-round outcomes. Observing the behavior of experimental subjects in both rounds allows us to investigate whether the experience of a zero-payoff outcome in the first choice situation affects participant's behavior in a second choice situation and whether the source of the zero-payoff matters. Payoffs are determined by joint play between the subject and a co-player in a

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game of chicken and by the outcome of a lottery draw. Specifically, the zero-payoff event can occur when a "red ball" is drawn in the lottery (natural uncertainty), or when both participants play "action B" in the chicken game (strategic uncertainty).

While the rounds are independent in statistical (random rematching) and payoff terms (random determination of payoff–relevant round), casual observation and evidence from cognate experiments suggests that choice behavior is likely to differ depending on whether the zero-payoff event materialized or not. This behavioral response conceivably also differs depending on whether natural or strategic uncertainty is seen as the reason for the zero-payoff event. Our experiment is designed to detect the presence and nature of such behavioral changes. Furthermore, we ask whether age, gender, or educational status can explain observed choices and changes in choices. Finally, we study whether a change in the perception of what caused the outcome mediates the effect of experience on the change in choices.

2 Experimental Design

2.1 Overview

The key contribution of our research design is to cleanly disentangle strategic uncertainty from natural uncertainty. We match participants with a co-player to play a game of chicken (normal-form matrix is shown in Figure 1). The eventual payoff of the players depends on their play in the game and on the draw of a lottery. That is, when a "red ball" is drawn in the lottery, or when both players choose "action B" in the chicken game, they receive a payoff of zero. When a participant chooses "action A" in the chicken game, and a "green ball" is drawn in the lottery, she receives a payoff of x and when a participant chooses "action B" in the chicken game, while her co-player chooses "A", and a "green ball" is drawn in the lottery, she receives a payoff of $x + y$.

		Player 2	
		A	B
Player 1	A	x , x	x , $x+y$
	B	$x+y$, x	0 , 0

Figure 1: Normal form of the chicken game

We play two rounds of this game and randomly rematch players (perfect stranger matching). After the first round, full information about the outcome of the lottery and the choice of the matched co-player is provided. Participants receiving a payoff of zero will therefore know exactly whether the event can be attributed to the unfortunate realization of the natural uncertainty, or the strategic uncertainty, or both. In round two, participants are tasked to again choose between A and B.[1] Finally, we ask participants not only to make payoff-relevant choices, we also elicit their perceptions about the cause of the outcome. We do so at two points in time: first, after they have made their first choice but before they know the outcome, and second, after they have learned the outcome from the first round and before they make their second choice.

We consider participants who receive a zero payoff in the first round to be treated. We compare their behavior to those untreated, that is, those who receive a non-zero payoff in the first round. Those who are treated can be further subdivided into those who receive the zero payoff because of the random draw (red ball) and those who receive it as a result of the strategic choices in the chicken game (strategy combination $\{B, B\}$). Both of these comparisons are within-person.

We refer to the previously described treatment as the **human condition HC**, because participants are matched with a human co-player. In addition, we also run a treatment in which the co-player is the computer. We refer to this treatment as the **robot condition RC**. The computer co-player plays each of its strategies with probabilities equal to the empirically observed choice frequencies by human players in the pilot studies. Otherwise, the design is the same. This additional treatment serves as a control condition in a between-subject fashion. In the robot condition, participants know that there is not any strategic element to the co-player's choice. They only face natural uncertainty, both from the urn draw and the random strategy selection by the computer. In contrast, in the human condition, participants face natural uncertainty from the urn draw, but strategic uncertainty about the other player's choice in the chicken game. Comparing behavior across these two between-subject treatments thus allows us tease out the effect of different sources of uncertainty.

2.2 Calibration

Because natural and strategic uncertainty are independent, there are eight different histories in the first round of the experiment that we present in Table 1. We introduce the following notation: The choice of player i in round t is denoted by $C_{i,t} = \{\text{A}; \text{B}\}$ (parallel for player j). The realization of the lottery is denoted by $L_t = \{\text{red}; \text{green}\}$. The payoff of player i for round t is denoted by $\pi_{i,t}$. Finally, let $Z_t = \{0; 1\}$ denote whether the zero-payout event has occurred in round t or not. For easier reference, we number

[1] Only one of the two rounds will be randomly selected for payout so that there are no income effects that carry over from the first to the second round of the game.

the eight different histories in the first round H=h1,...,h8. The last column of Table 1 gives the probability that a given history occurs, where we denote the probability that a red ball is drawn in the lottery by p (that is, $p = \Pr(L = \text{red})$) and the probability that participant chooses "action B" by q. This means, for example, that the history h1, according to which a green ball is drawn from the urn and both players choose "A", occurs with probability $(1-p)(1-q)^2$.

H	$C_{i,1}$	$C_{j,1}$	L	Z_1	$\pi_{i,1}$	$\Pr(H=\text{h}n)$
h1	A	A	green	0	x	$(1-p)(1-q)^2$
h2	A	B	green	0	x	$(1-p)(1-q)q$
h3	B	A	green	0	$x+y$	$(1-p)q(1-q)$
h4	B	B	green	1	0	$(1-p)q^2$
h5	A	A	red	1	0	$p(1-q)^2$
h6	A	B	red	1	0	$p(1-q)q$
h7	B	A	red	1	0	$pq(1-q)$
h8	B	B	red	1	0	pq^2

Table 1: The eight different histories in the first round

As can be seen from Table 1, for a given q, we can calibrate p to obtain different distributions of our sample over histories (at least in terms of ex-ante likelihood). We aim for a distribution where it is equally likely that the zero payoff event is caused by both player's choosing "B" or by the ball being "red", which requires[2] $p = q^2$.

Of course, q is unknown as it depends on the behavior of the participants (this may, in fact, depend on p, even though the two probabilities are independent). To this end, we have conducted three pilots with different values of p and observed the resulting q in the first decision that participants took. Specifically, we observed a value of q=0.36 in the pilot with p=0.4 (N=81), a value of q=0.38 in the pilot with p=0.2 (N=107), and a value of q=0.47 in the pilot with p=0.1 (N=92). Although we do see that the point estimate of q decreases with p, these values are statistically indistinguishable. Given the data from the pilot, we set p=0.2.

To provide sufficient incentives, we set the payoffs to x=1 USD and y=2 USD, which is comparatively high for short surveys that are offered in online labor markets.

[2] $\Pr(H = \text{h4}) = \Pr(H \in \{\text{h5,h6,h7}\}) \Rightarrow (1-p)q^2 = p(1-q)^2 + 2pq(1-q) \Leftrightarrow p = q^2$.

2.3 Identification

The fundamental challenge to identify whether the reason for the zero-payoff event matters for changing the choice in the second situation is that only those participants that choose "action B" in the first round are in a position to experience both natural or strategic uncertainty. For those participants that choose "action A" in the first situation, only natural uncertainty can be the cause of the zero payoff event. Obviously, this could lead to a significant selection bias.

To overcome this, we assign the first round action to some participants. Denote the intended action of participant i in the first round by $\hat{C}_{i,1}$. For a share 1-σ of the participants, their choice is implemented as their action ($\hat{C}_{i,1} = C_{i,t}$). For a share σ of the participants, however, their preferred choice is not implemented as their action. Instead, the opposite of the preferred action is implemented. For the respective co-players, we always implement their intended action ($\hat{C}_{j,1} = C_{j,t}$). Similarly, the choice in second round is not perturbed for any player.

Because we set $\sigma < 1$, the incentive structure is kept identical across the two rounds. However, to maximize the efficiency of our design, the share of assigned actions depends on whether a given participants chooses A or B (that is, $\sigma^A \neq \sigma^B$). Specifically, participants that express their preference for action A are assigned the action B with a probability of σ^A=0.98 and participants that express their preference for action B are assigned the action A with a probability of σ^B=0.01.

We instruct the participants as follows: "For your own action, you can choose whether you prefer option A or option B. Your preferred option may not necessarily be implemented as your action. But choosing your preferred option maximizes the chances that it is implemented. Your co-player's choice is always directly implemented."

This setup allows us to make a statement on how the nature of experience affects subsequent choice for the full sample of participants, and not only for those subjects that expose themselves to strategic uncertainty because they prefer action B.

2.4 Implementation

The experiment is conducted online with participants being recruited from the Amazon Mechanical Turk platform. We use o-Tree (Chen et al., 2016) to program the experiment. The full instructions are provided in the Appendix and Figure A-1 and Figure A-2 show screenshots of the choice situations. Figure 2 illustrates the flow of the experiment.

After the introduction where participants give consent to participate, we present the rules of the game. We also announce, based on past experience with the pilots, the

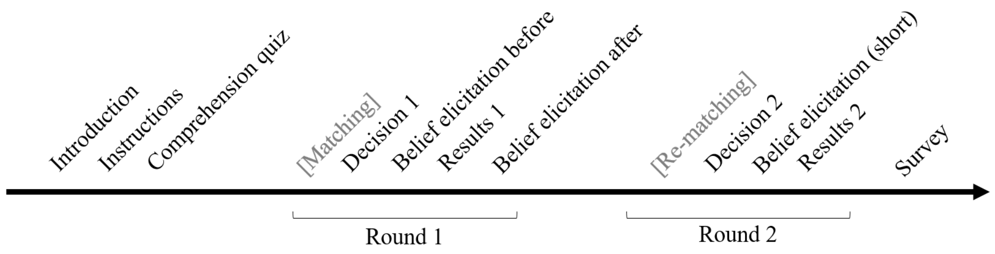

Figure 2: Stages of the experiment

likelihood of the co-player playing A or B.

In the RC treatment condition, participants are informed that their co-player is the computer. They are likewise informed about the likelihood of the computer co-player playing A or B, which is identical to the main treatment.

The participants then have to complete six comprehension questions and then wait for another participant they are matched with. Participants have the possibility to exit the experiment at this stage when no other participant shows up within 2 minutes.

Once two participants are paired, they make their first decision ("A" or "B") and afterwards indicate how they perceive the situation in three questions which are presented on separate screens. The participants then see what their co-player has chosen, the outcome of the urn draw and the resulting payoff consequences. After seeing the results, participants are again asked to state whether they perceived that the outcome of the game was determined by chance or their choices.

Then, participants are matched with a different co-player and choose between A and B in the second game. Here, we ask them to state their beliefs about the co-player choice and the urn draw, but not their perceptions of what determined the outcome. After seeing the results from the second game, participants take a short survey where we ask about age, gender, educational level and a generic assessment about their willingness to take risks, completing the experiment.

[2] First, we ask whether they think that the outcome depends on chance or their choices (see Figure A-3), second we ask about their assessment of the probability that their respective co-player chose A or B (see Figure A-4), and third we ask about their assessment of the whether the ball drawn from the urn is "red" or "green".

3 Empirical Strategy

In this section, we describe our specific hypotheses and how we aim to test them. We have three overarching research questions: First, does the experience of a zero payoff outcome in the first round affect choice in the second round? Second, can the choice and the potential change choice be explained by participant characteristics? Third, does a change in the perception of what caused the outcome mediate the effect of experience on the change in choices?

3.1 Definitions

Before we turn to how we operationalize these three questions and test the corresponding hypotheses, it us useful to define a number of variables that we use in the analysis.

- **Indicator of change in choice:** We define Y_i=0 if $C_{i,1}$=$C_{i,2}$ and Y_i=1 if the action chosen in the second round is the opposite of the action implemented in the first round ($C_{i,1}$≠$C_{i,2}$).
- **Participant characteristics:** In the survey, we ask about the participants age, gender, and level of education. We define $female$ as an indicator variable which takes the value of 1 if the participant is female and zero otherwise. The variable *age* is a continuous variable (values between 13 and 99 are admissible), and the variable *educ* is a categorical variable ranging between 0 (less than high school degree) and 5 (graduate degree).
- **Perception of control:** This variable is derived from the question "to what extent do you think the outcome is due to chance or due to your and your co-player's choices". It is a continuous variable that takes a value of 0 if the slider is set all the way to the left (i.e. "chance") and a value of 100 if it is set all the way to the right (i.e. "your and your co-player's choices"). We denote this variable by m_b or m_a, denoting whether the perception was elicited before (b) the first choice or after (a).
- **Change in perception of control:** This variable measures the change in perception, and we denote it by M_i, that is $M_i = m_a - m_b$.

In addition, we recall the variable definitions used in Table 1: The set of histories h1 to h8 is denoted by H. The variable Z_t denotes whether the zero-payout event has occurred in round t (Z_t=1) or not (Z_t=0), and the outcome of the lottery is denoted by L_t.

3.2 Univariate analysis: The effects of experience

Provided that all participants are fully rational players and believe that all other participants are also fully rational, standard game theory gives a clear prediction about the outcome of the experiment. The strategic choice situation of the participants has the form of a chicken game. The chicken game has a Nash equilibrium in mixed strategies ($q^* = \frac{2}{3}$). Subjects are informed about previous average play in this game form and given the same parametrization. Subjects are also informed about the probability of a bad draw in the lottery. Moreover, the probability is independent of the strategic choice and partner reassignment between rounds is randomized. Both the information about average play and about the lottery remain the same in the first and the second round. In such a setting, standard game theory predicts that no change in **average** behavior should be observed.

If deviations from fully rational play or from the belief in other players' fully rational play are taken into account, then alternative predictions about average behavior arise. Deviations from fully rational play could come from any one of several different behavioral effects:.

- *Recency effect* Participants could update their beliefs about the lottery or about the co-player's action in the direction of the most recent observation, even though the probabilities have not changed statistically.
- *Variety effect* Participants could value variety of choice for its own sake.
- *Experimentation effect* Participants could believe that they learn something about the game by changing play.

This characterization of alternative behaviors is neither exhaustive nor complete. Likewise, the beliefs in the population about the presence of rational or alternative behavioral types are unknown. The agnostic prediction is therefore captured in hypothesis 1.

Hypothesis 1 *Experience does not affect behavior.*

Because the assigned action for some participants is different from their preferred option, we expect that there is a subgroup-specific share of participants that change their choice. However, this share is independent of whether the zero-payoff event occurred or not. Hypothesis 1 can therefore be tested by a binomial test, where we expect:

$$\mathrm{E}[Y|Z_1{=}0] = \mathrm{E}[Y|Z_1{=}1] \tag{1}$$

Turning to the differential effect that the way how the zero payoff outcome came about might have, it is important to recall that only the subgroups with the implemented action $C_{i,1}$=B can experience a zero-payoff event due to both strategic or natural uncertainty. This is illustrated in Table 2, showing the distribution of histories according to the co-player's action $C_{j,1}$ and the outcome of the lottery L_1.

		L_1 green	L_1 red
$C_{j,1}$	A	h3	h7
	B	h4	h8

Table 2: Possible histories conditional on $C_{i,1}$=B

One could think that participants who have received zero payoff because both themselves and their co-players have chosen action "B", while the ball drawn from the urn was green, are more cautious in the second choice situation and therefore more likely to change to choosing action A. Similarly, one could think that participants that have observed a zero payoff outcome that was uniquely caused by the draw of a red ball from the urn are more likely to continue choosing action B in the second round because they perceive that their choice matters less for the outcome. If this were the case, we should observe that $\mathrm{E}[Y|\mathrm{h4}] > \mathrm{E}[Y|\mathrm{h7}]$.

However, one might as well think that participants become more optimistic about the urn after having observed a green ball and are thus more likely to stick to their choice, while participants having observed a red ball may become more cautious simply because they want to avoid an adverse experience. In this case we would expect to see $\mathrm{E}[Y|\mathrm{h4}] < \mathrm{E}[Y|\mathrm{h7}]$.

A priori, it is not obvious which of these potential mechanisms plays an important role. Lacking a clear behavioral theory, we therefore formulate an undirected hypothesis:

Hypothesis 2: *The nature of experience does not affect behavior*

We reject the null hypothesis if the average change in choice, conditional on experiencing history h4, is significantly different from the average change in choice after experiencing history h7.

(2) $$\mathrm{E}[Y|\mathrm{h4}] = \mathrm{E}[Y|\mathrm{h7}]$$

Additionally, we can test whether the reaction is the same for those that originally intended to choose action A or not:

$$\text{(3)} \qquad \mathrm{E}[Y|\mathrm{h4} \wedge \hat{C}_{i,1}{=}A] = \mathrm{E}[Y|\mathrm{h7} \wedge \hat{C}_{i,1}{=}A]$$

$$\text{(4)} \qquad \mathrm{E}[Y|\mathrm{h4} \wedge \hat{C}_{i,1}{=}B] = \mathrm{E}[Y|\mathrm{h7} \wedge \hat{C}_{i,1}{=}B]$$

To complete the core analysis of choice data, we finally exploit the presence of the between-subject control group (the robot condition **RC**). In terms of economic outcomes, the **RC** is indistinguishable from the human condition **HC**. The only difference lies in the fact that it is a computer co-player that determines play of A or B. The RC thus replaces the strategic uncertainty of the **HC** with another natural uncertainty, i.e. the random outcome of the computer co-player's choice.

Given the evidence provided by Fox and Weber (2002) for participants to be sensitive to the source of uncertainty, we expect participants to behave differently in the **RC** compared to the **HC**. The direction of the effect, however, remains unclear. We start by looking at the choices in participants' s first decision situation across conditions and test the following null hypothesis:

Hypothesis 3: *Decisions in round one do not differ between HC and RC.*

We test the hypothesis by means of a two-sample chi-squared test. The hypothesis is to be rejected if the number of "B" choices is significantly different between the two conditions.

$$\text{(5)} \qquad \Pr(C_{i,1} = B|\mathrm{HC}) \;=\; \Pr(C_{i,1} = B|\mathrm{RC})$$

To study whether the changes in behavior between rounds one and two differs between HC and RC, we turn to a regression analysis that can incorporate interaction effects. The corresponding null hypothesis is:

Hypothesis 4: *Behavioral change as a result of a zero-payoff event in the robot condition does not differ from behavioral change as a result of a zero-payoff event in the human condition.*

We reject the hypothesis if the difference in the average change in choice between experiencing history h4 (zero-payoff due to a bad draw in the lottery) and experiencing history h7 (zero-payoff due to both players choosing "B") is different between the human condition and the robot condition.

$$\text{(6)} \qquad \mathrm{E}[X|\mathrm{HC}] = \mathrm{E}[X|\mathrm{RC}] \qquad \text{where } X = \mathrm{E}[Y|\mathrm{h4}] - \mathrm{E}[Y|\mathrm{h7}]$$

3.3 The mediating effect of perception

How participants perceive the choice situation may play an important role. We explore this using mediation analysis (Preacher and Hayes, 2008; Tabachnick and Fidell, 2013).

In our setting, this translates to:

1. A logistic regression of Y on Z (parameter estimates: log odds ratio's)
2. ANOVA with the change in perception M as dependent variable, and experience Z as independent variable (parameter estimates: F).
3. A logistic regression of Y on M (parameter estimates: log odds ratio's).
4. A logistic regression on change of choice as dependent variable, change in perception as independent variable, experience Z as independent variable (parameter estimates: log odds ratio's).

We formulate the following three hypotheses:

Hypothesis 5: The change in perception (from before to after the outcome) will mediate the effect of experience on the change in choices.

To test this hypothesis, all data will be included in the analysis. A mediation analysis will test if the perception can mediate the effect of the experience on the change in choices.

Hypothesis 6: Participants who have experienced a zero-payoff outcome will perceive a stronger influence of the ball draw (or external control) after this event (compared to before the event), which will result in a higher likelihood to change from choosing B to choosing A.

To test this hypothesis, data will be selected from participants who 1) chose B in round 1, 2) experienced a zero payoff. A mediation analysis will test if these participants will perceive a stronger influence of the ball draw (or external control) after this event (compared to before the event), which will result in a higher likelihood to change from choosing B to choosing A.

Hypothesis 7: Participants who have experience a *non-zero payoff* outcome will perceive a stronger influence of the choices made in the game (or internal control) after this event (compared to before the event), which will result in a higher likelihood to change from choosing A to choosing B.

To test this hypothesis, data will be selected from participants who 1) chose A in round 1, 2) experienced a non-zero payoff. A mediation analysis will test if these will perceive a stronger influence of the choices made in the game (or internal control) after this event (compared to before the event), which will result in a higher likelihood to change from choosing A to choosing B.

3.4 Participants' characteristics

Individual characteristics may play an important role. We will control for participants' characteristics such as age, gender, level of education, and general propensity to take risks in the multivariate analysis.

There is ample of evidence for women being more risk averse than men (Eckel and Grossman, 2008; Croson and Gneezy, 2009). Similarly, age has been found to affect behavior in these types of games, yet in a weaker fashion (Harbaugh et al., 2002). The educational level in turn is unlikely to have strong behavioral effects, but it may explain why participants do not switch actions, as more educated participants are more likely to understand the independent nature of the two lotteries.

We explore these effects by regressing the intended first period choice ($\hat{C}_1$) and the indicator of a change in choice (Y) on the explanatory variables $female$, *age*, and *educ*. As the dependent variables are ordinal (and binary in the first case), logit regression models are suitable.

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Appendix

Figure A-1 and Figure A-2 show how the first and the second choice situation is presented to the participants. Figure A-3 and Figure A-4 show two of the belief elicitation questions. The screenshots are followed by the instruction text.

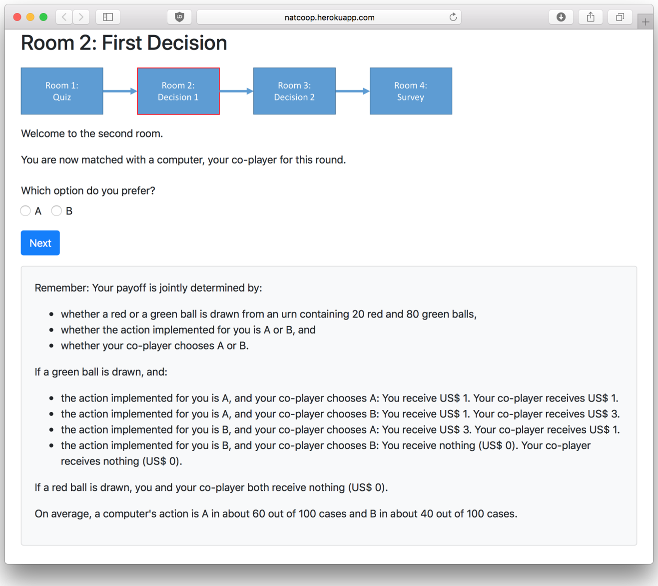


Figure A-1: Screenshot Choice situation 1

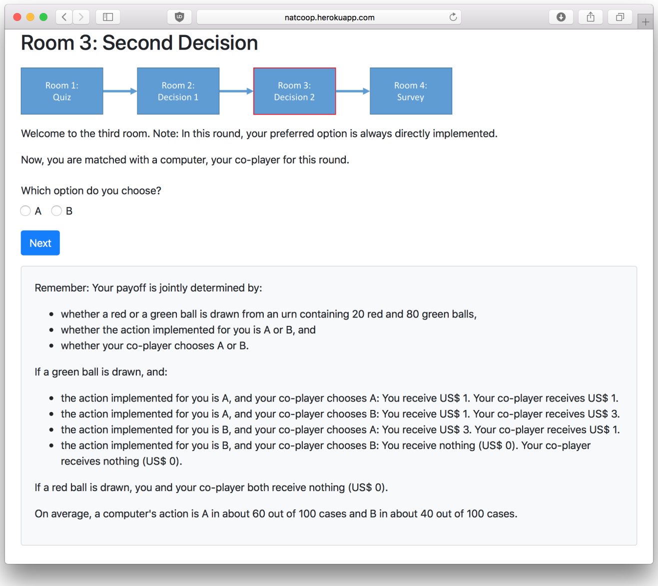


Figure A-2: Screenshot Choice situation 2

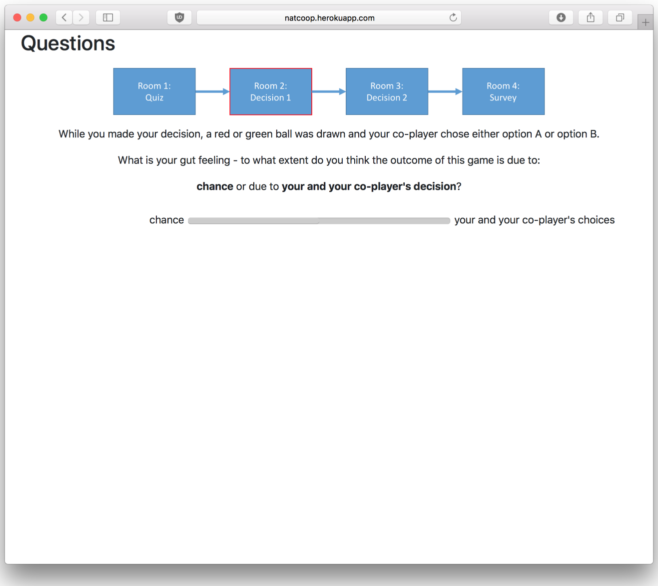


Figure A-3: Screenshot Perception before results are known

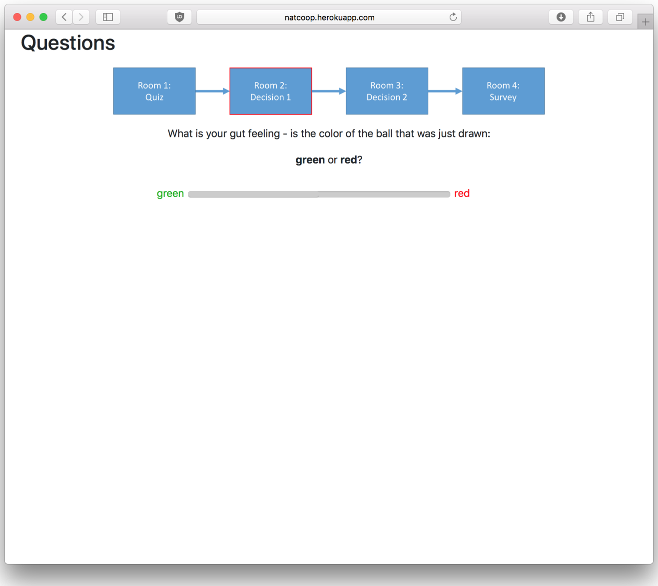


Figure A-4: Screenshot Belief about urn draw

Instructions

Legend: [page references], [treatment differences], [user interface elements]

[mTurk title]
Research in Decision Making

[mTurk description]
Participate in a game and a short survey. Please note that the task is to be completed within 10-15 minutes as you are matched with a co-player.

[mTurk preview, on separate screen]

Please read this carefully before clicking ‘accept’.
This HIT is an academic research study on decision making.

Research goal:
In this study, we are interested in decision making under uncertainty. You will be matched with co-players and you will be asked to take a decision.

Duration and reward:
The entire study will take about 10 minutes. Your payment consists of a fixed reward of $0.50 via Amazon Mechanical Turk for successful completion and a bonus that depends on your and the co-players’ decisions as well as on chance. You are also asked to complete a short and anonymous survey.

Please note that the task should be completed without delay.

Confidentiality:
All data we collect is treated confidentially and will only be used for our research purpose. Your name will not be linked to the results in any way.

Requirements:
To participate, you need to be located in the United States of America. You may not have participated in this study before. There are no other formal requirements for participation.

Voluntary participation:
Participation in this study is voluntary. If you do not want to take part in the study, please do not accept the HIT. If you want to participate, please be sure you can commit to completing the HIT before accepting it - if you discontinue participation, you will not receive any bonus.

Contact:
If you have any questions regarding this study, please contact Florian Diekert natcoop@awi.uni-heidelberg.de.

[accept HIT]

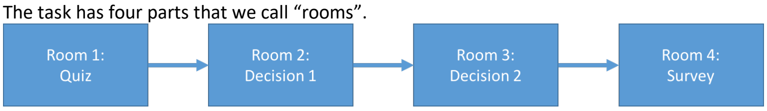
[Introduction]

Introduction
Thank you for participating.

In this task you are asked to make two decisions.
For each decision, you will be matched with a co-player.
If you read these rules carefully and choose wisely, you can earn up to US$ 3.50.

Completing this task will take about 10 minutes and it is important that you pay close attention during this time to not spoil the task for you and the other participants.

The task has four parts that we call “rooms”.



In the first room, you take a small quiz on the rules.
In the second room, you make the first decision where you are matched with a co-player and we will ask you some questions.
You may have to wait for a minute in this room until your co-player has finished and you can know the outcome.
In the third room, you make the second decision where you are matched with a different co-player.
Again, you may have to wait for a minute in this room until your co-player has finished and you can know the outcome.
Finally, in the fourth room, you are asked to fill out a short survey.

Note that only one of the two decisions from rooms 2 and 3 will be selected for payment at random. As it is unknown which of the two decisions count, it is important to pay equally close attention to both.

[next]

[Instructions 1]

Rules

[if human]
You are randomly matched with a co-player. Your co-player is another participant in the exact same situation as you.

[else, if computer]
You are randomly matched with a co-player. Your co-player is not a human, but a computer. Your play does not affect the computer's decision.

Three factors together determine your payoff:
(1) The draw of a ball from an urn,
(2) your own action, and
(3) the action of your co-player.

The urn from which the ball is drawn contains 100 balls. 20 balls are red, 80 are green.
If a red ball is drawn, you receive nothing (US$ 0) irrespective of your and your co-player's decision. So does your co-player.
If a green ball is drawn, then your outcome depends on your and your co-player's action (see below). You will not know the outcome of the draw from the urn at the time of taking your decision.

For your own action, you can choose whether you prefer option A or option B. Your preferred option may not necessarily be implemented as your action. But choosing your preferred option maximizes the chances that it is implemented. Your co-player's choice is always directly implemented.

These are the possibilities:

- A green ball is drawn and **action A is implemented for you** and your **co-player's action is A**: You receive US$ 1. So does your co-player.
- A green ball is drawn and **action A is implemented for you** and your **co-player's action is B**: You receive US$ 1. Your co-player receives US$ 3.
- A green ball is drawn and **action B is implemented for you** and your **co-player's action is A**: You receive US$ 3. Your co-player receives US$ 1.
- A green ball is drawn and **action B is implemented for you** and your **co-player's action is B**: You receive nothing (US$ 0). So does your co-player.

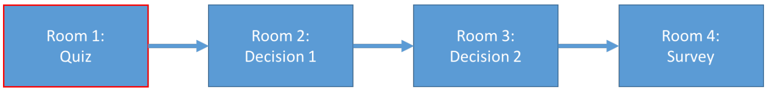
To repeat: If a red ball has been drawn, you receive nothing (US$ 0).

[if human]
In a previous experiment, the co-players' action was A in about 60 out of 100 cases and B in about 40 out of 100 cases.
[else, if computer]
On average, a computer's action is A in about 60 out of 100 cases and B in about 40 out of 100 cases.

[next]

[comprehension]

Room 1: Quiz



Welcome to the first room.
Here you have the chance to check whether you have properly understood the rules of the game. Please answer the following questions.

Question 1:
Which of the following is correct? In Room 2 and 3, my co-player is

- the same real person in both rooms.
- a different real person in each room.
- a computer player.

[If human: option 2 is correct; else if robot: option 3 is correct]

Question 2:
Which of the following is correct? On average, co-players

- choose A more often than B.
- choose B more often than A.
- choose A and B equally often.

[option 1 is correct]

Question 3:
What is your payout if action A is implemented for you, your co-player's action is B, and the ball is red?

- US$ 1
- US$ 0
- US$ 3

[option 2 is correct]

Question 4:
What is your payout if action A is implemented for you, your co-player's action is B, and the ball is green?

- US$ 1
- US$ 0
- US$ 3

[option 1 is correct]

Question 5:

What is your payout if action B is implemented for you, your co-player's action is B, and the ball is green?

- US$ 1
- US$ 0
- US$ 3

[option 2 is correct]

Question 6:
Remember that only one of the two decisions counts for your payment, with equal chance. What does this mean?

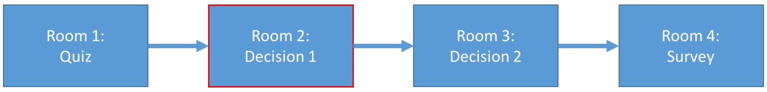
- The second decision is less important than the first one.
- Both decisions are equally important.
- The second decision is more important than the first one.

[option 2 is correct]

[check answers]
[if correct / corrected: next]

[decision 1]

Room 2: First Decision



Welcome to the second room.
[if human]
You are now matched with another participant, your co-player for this round.

[else, if computer]
You are now matched with a computer, your co-player for this round.

Which option do you prefer?

- A
- B

[next]
[instructions reminder box]
Remember: Your payoff is jointly determined by

- whether a red or a green ball is drawn from an urn containing 20 red and 80 green balls,
- whether the action implemented for you is A or B, and
- whether your co-player chooses A or B.

If a green ball is drawn, and:

- the action implemented for you is A, and your co-player chooses A: You receive US$ 1. Your co-player receives US$ 1.
- the action implemented for you is A, and your co-player chooses B: You receive US$ 1. Your co-player receives US$ 3.
- the action implemented for you is B, and your co-player chooses A: You receive US$ 3. Your co-player receives US$ 1.
- the action implemented for you is B, and your co-player chooses B: You receive nothing (US$ 0). Your co-player receives nothing (US$ 0).

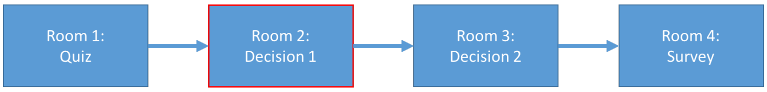
If a red ball is drawn, you and your co-player both receive nothing (US$ 0).

[if human]
In a previous experiment, the co-player's action was A in about 60 out of 100 cases and B in about 40 out of 100 cases.

[else, if computer]
On average, a computer's action is A in about 60 out of 100 cases and B in about 40 out of 100 cases.

[belief chance or decision 1]

Questions



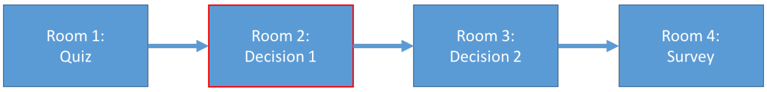
While you made your decision, a red or green ball was drawn and your co-player chose either option A or option B.

What is your gut feeling - to what extent do you think the outcome of this game is due to:

chance or due to **your and your co-player's decision**?

[slider, 0-100]
[next]

[belief ball color 1, on separate screen]
Questions

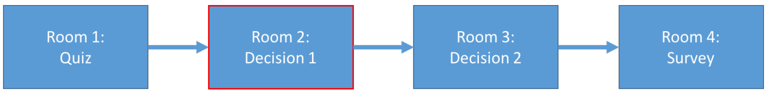


What is your gut feeling - is the color of the ball that was just drawn:

green or **red**?

[slider, 0-100]
[next]

[belief other's decision 1, on separate screen]
Questions



What is your gut feeling - did your co-player just choose:

A or **B**?

[slider, 0-100]
[next]

[results 1]

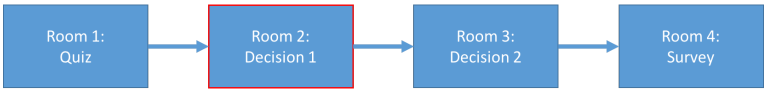
Results Room 2

You chose **{A/B}**. Action {A/B} was implemented for you.
Your co-player's action was **{A/B}**.
The ball drawn from the urn is **{green/red}**.

As a result you earned **{payoff}** if this room is selected for payment.

[next]

[belief chance or decision 2, on separate screen]
Questions



Now that you have learned the outcome, please answer this question again.

While you made your decision, a red or green ball was drawn and your co-player chose either option A or option B.

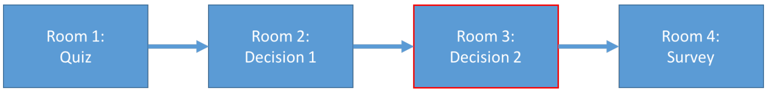
What is your gut feeling - to what extent do you think the outcome of this game was due to:

chance or due to **you and your co-player's decision**?

[slider, 0-100]
[next]

[decision 2]

Room 3: Second Decision



Welcome to the third room. Note: In this round, your preferred option is always directly implemented.

[if human]
Now, you are matched with a different participant, your co-player for this round.
[else, if computer]
Now, you are matched with a computer, your co-player for this round.

Which option do you choose?

- A
- B

[next]
[instructions reminder box]
Remember: Your payoff is jointly determined by

- whether a red or a green ball is drawn from an urn containing 20 red and 80 green balls,
- whether the action implemented for you is A or B, and
- whether your co-player chooses A or B.

If a green ball is drawn, and:

- the action implemented for you is A, and your co-player chooses A: You receive US$ 1. Your co-player receives US$ 1.
- the action implemented for you is A, and your co-player chooses B: You receive US$ 1. Your co-player receives US$ 3.
- the action implemented for you is B, and your co-player chooses A: You receive US$ 3. Your co-player receives US$ 1.
- the action implemented for you is B, and your co-player chooses B: You receive nothing (US$ 0). Your co-player receives nothing (US$ 0).

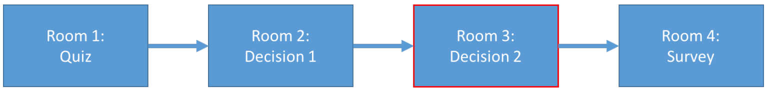
If a red ball has been drawn, you and your co-player both receive nothing (US$ 0).

[if human]
Based on previous sessions of this experiment, a co-player chooses A in about 60 out of 100 cases and B in about 40 out of 100 cases.

[else, if computer]
On average, a computer chooses A in about 60 out of 100 cases and B in about 40 out of 100 cases.

[belief ball color 2]

Questions



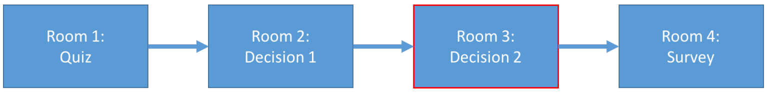
What is your gut feeling - is the color of that ball that was just drawn:

green or **red**?

[slider, 0-100]
[next]

[belief other's choice 2, on separate screen]

Questions



What is your gut feeling - did your co-player just choose:

A or **B**?

[slider, 0-100]
[next]

[results 2, on separate screen]

Results Room 3

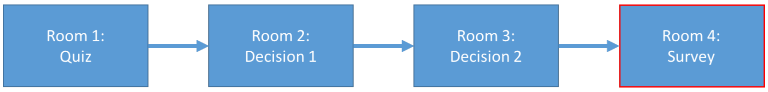
You chose **{A/B}**. Action {A/B} was implemented for you.
Your co-player's action was **{A/B}**.
The ball drawn from the urn is **{green/red}**.

As a result you earned **{payoff}** if this room is selected for payment.

[next]

[demographics]

Survey



Welcome to the fourth and final room. We ask you to answer these few questions before you complete the experiment.

What is your age?
[number input]

What is your gender?
- Male
- Female
- Other
- I prefer not to tell

What is the highest level of school you have completed or the highest degree you have received?
- Less than high school degree
- High School degree or equivalent (e.g. GED)
- some college, but no degree
- Associate degree
- Bachelor degree
- Graduate degree

If you had at least some college education, please tell us your major:
[free text input]

How do you see yourself: Are you in general a person who takes risk (10) or do you try to avoid risks (0)? Please self-grade your choice (0-10).
[slider, 0, 10]

[next]

[last page]

Completed

Thank you for your participation, your answers were transmitted.

Your payment consists of the fixed reward of US$ 0.50 and the payout from room 2 or room 3.

In your case, room **{2/3}** was randomly selected for payout, where you earned **{payoff}**.
In total, you receive: **{payoff plus participation fee}**.

If you have any questions regarding this study, please write a mail to the study team natcoop@awi.uni-heidelberg.de.

[finish study]