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Abstract

This experiment seeks to study the impact of uncertainty and attitudes towards uncertainty on charity donations. We use a modified dictator game, where the donations received by the beneficiaries (environmental NGOs) are exposed to different levels of uncertainty. We study the level of donations and elicit risk aversion, ambiguity aversion, likelihood insensitivity, and pessimism. We aim to test if different levels of uncertainty at the receiver level (risk and ambiguity) impact donations. We do not find any differences between levels of uncertainty compared to no uncertainty. We find that a "high" level of ambiguity has a significant and negative effect on altruistic behavior compared to a risk or a"low" ambiguity environment. We also find that the effect of pessimism depends on the level of ambiguity. We find no effect of ambiguity aversion, likelihood insensitivity, and pessimism under "low" ambiguity on altruistic behavior. Meanwhile, under "high" ambiguity, we find a negative effect of pessimism on charitable giving. These results suggest that there is a threshold for which ambiguity and ambiguity attitudes have a negative impact on donations.

JEL classification: C91, D64, D81

Keywords: Charitable giving, uncertainty, pro-social behavior, ambiguity attitudes

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1 Introduction

For the last few years, charitable giving has increased in most countries. For instance, in France, the amount donated has increased by 27% between 2013 and 2021[1]. The importance of charities lies in their provision of public goods from private entities. A large literature has focused on determinants of charitable giving (see the review by Bekkers and Wiepking (2011)); however, not much attention has been given to the impact of risk and ambiguity, although in some cases, individuals do not know exactly if their donations will effectively have the intended impact and to what extent. This is specifically true for environmental NGOs. More generally, individuals are not always certain of how their donations are being used. Some actions undertaken by NGOs and their impact are easily observed, such as the cleaning of a forest. However, for other actions, it is difficult to know the real impact undertaken by charities. For instance, the impact of actions aiming to increase environmental quality or to decrease pollution is distant in time and difficult to quantify; they are also difficult to observe. Determining if the improvement of environmental quality comes from the actions undertaken by a specific NGO or not is not straightforward.

Furthermore, the presence of uncertainty leads to the misperception about the impact of donations and not being able to estimate its impact correctly through the over or underestimation of it, which could lead to non-efficient levels of donations. In the case of NGOs, uncertainty can have different sources; NGOs possess different levels of cost-effectiveness, and individuals generally do not know the level of cost-effectiveness of NGOs because of a lack of transparency. Some NGOs have high operating costs or collection fees. Charities are not equally cost-effective, and individuals are not always able to know about the impact of their donations.

Another source of uncertainty can come from a risk of misappropriation of donations; for example, in 2019, the Red Cross revealed that 5 million euros that were supposed to fight against the Ebola virus in West Africa were embezzled between 2014 and 2016. Depending on the NGO, these risks are more or less important.

Hence, individuals may have biased beliefs about the consequences of their donations and that the benefits and the positive impact of their donations will effectively occur, affecting their perception of uncertainty. An individual might underestimate the impact of her donations, believing, for instance, that donations will not have the expected impact (for instance, thinking that all of her donations will be embezzled).

[1] La générosité des Français, 27ème édition, Novembre 2022.

An individual might also underestimate the impact of her donations by not taking into account the multiplier effect of the pooling of contributions. That is the case when, for example, a certain amount of money is targeted to allow the realization of a project. Moreover, individuals do not equally behave when risk is on their side or on the beneficiaries' side.

The presence of uncertainty may or may not be probabilized. It is common not to know the exact amount of a donation that will be used for the intended cause. Therefore, studying different levels of risk and ambiguity is relevant. We can distinguish two levels of uncertainty: probabilized uncertainty (risk), individuals know about the probability distribution of the possible events. And non-probabilized uncertainty (ambiguity), where the available information is too imprecise to associate a probability to each event: the individuals do not know the probability distribution of the possible events. Studies that have focused on the impact of risk on donations (Haisley and Weber, 2010; Krawczyk and Le Lec, 2010; Brock, Lange and Ozbay, 2013; Exley, 2016; Freundt and Lange, 2017; Cettolin, Riedl and Tran, 2017) found that altruistic behaviors are reduced under risk. Other studies focusing on studying ambiguity and donations (Haisley and Weber, 2010; Cettolin, Riedl and Tran, 2017; Garcia, Massoni and Villeval, 2020); however, found contradictory results, leading to a lack of consensus on the effect of ambiguity in donations.

In this perspective, in this paper, we study the impact of different levels of uncertainty (risk and ambiguity) and attitudes towards risk and ambiguity on donations to charity and make an attempt to clarify this lack of consensus. We also seek to study the impact of risk and ambiguity attitudes. Some papers have studied the role of risk aversion on altruistic behavior (Freundt and Lange, 2017; Cettolin, Riedl and Tran, 2017; Fahle and Sautua, 2021), finding mixed effects on altruistic behaviors. Ambiguity attitudes are characterized by two cognitive components. Ambiguity aversion, which is defined as how much a person dislikes ambiguity; (ambiguity generated) likelihood insensitivity which is defined as the insensitivity to changes in likelihood. Finally, besides ambiguity attitudes, we also study the impact of pessimistic beliefs, which is the over-weighting of the probability of realization of the worst possible event. To our knowledge, only Cettolin, Riedl and Tran (2017) studied the impact of ambiguity aversion on donations, however, there are no other papers that have studied the impact of likelihood insensitivity or pessimism on donations.

In this paper, we aim at answering the following questions: How does the introduction of different levels of uncertainty have an impact on donations? What is the impact of ambiguity attitudes on charitable giving? To that aim, we conduct

a laboratory experiment where participants have the opportunity of donating to a charity when the amount received by the charity is unknown. We introduce different levels of uncertainty to each treatment: risk, lower ambiguity, and higher ambiguity.

We find that introducing risk, a "low" and a "high" level of ambiguity does not impact mean donations. However, we find that a "high" level of ambiguity decreases mean donations compared to a lower level of ambiguity and risk. We also find that ambiguity aversion and pessimism only play a role in donations when in the presence of a "high" level of ambiguity. However, we do not find any effect of ambiguity attitudes in lower levels of ambiguity.

The paper is organized as follows: section 2 summarizes the related literature, section 3 presents the experimental design, section 4 details the predictions of the experiment, and section 5 presents the results. Finally, section 6 discusses the results and concludes.

2 Related literature

We will split the literature in two levels of uncertainty: risk and ambiguity.

2.1 Risk

Krawczyk and Le Lec (2010), Brock, Lange and Ozbay (2013) and Freundt and Lange (2017) elicit altruistic behavior with a dictator game and show that altruistic behavior is reduced under risk. Furthermore, the literature focused on proving and isolating one of the reasons there is a decrease in charitable giving under risk: the presence of a moral wiggle room, where individuals use risk as a justification for unfair behavior. In the context of donations, Cettolin, Riedl and Tran (2017), and Exley (2016) find that the negative impact of riskiness comes from "the adoption of a favorable view of ambiguous risk" leading to a justification for unfair behavior (Haisley and Weber, 2010).

To the best of our knowledge, few studies have focused on risk attitudes regarding charitable giving. Furthermore, the literature is inconclusive about the effect of risk preferences on donations: Freundt and Lange (2017) find no effect of risk aversion on donations, Cettolin, Riedl and Tran (2017) showed that risk aversion decreases donations when risk is on the giver's side. However, they find that risk aversion has a positive effect on donations when risk is on the recipient's side. Fahle and Sautua (2021) found this positive effect exists for large-scale risk, and they also study the

impact of loss aversion on donations. In this paper, we focus on the impact of risk aversion when risk is on the recipient's side, bringing more evidence to the literature. We are also going to study the impact of risk aversion under ambiguity.

2.2 Ambiguity

Few papers have been studying ambiguity and charitable giving. There is no consensus in the literature about the impact of ambiguity. Haisley and Weber (2010) find a decrease in donations when introducing ambiguity, compared to risk. Cettolin, Riedl and Tran (2017) reveal mixed results; for some conditions, they find that individuals adopt a similar behavior regarding donations under risk and ambiguity, and for other conditions, they find a negative effect of ambiguity compared to risk. Garcia, Massoni and Villeval (2020) do not find any behavioral differences between donations under partial and full ambiguity, and they find that individuals do not use an increase of ambiguity to donate less. They also find that excuse-driven behavior is comparable under ambiguity and risk. However, they do find that introducing ambiguity decreases altruistic behaviors.

The lack of consensus might be due to the mixed effect of ambiguity in donations. The decrease in donations when introducing uncertainty is partly explained by excuse-driven behavior. However, as seen in the literature, the impact of excuse-driven behavior is the same for any level of uncertainty. Hence, other factors may also explain this decrease. The objective of this paper is to study what these other variables are and from what level of uncertainty they start/stop to matter in charitable giving and why.

As for ambiguity attitudes, only Cettolin, Riedl and Tran (2017) have studied the effect of ambiguity aversion on donations by using matching probabilities. We are unaware of any other papers that study other attitudes towards ambiguity, such as likelihood insensitivity, or beliefs, such as pessimism and charitable giving. Our experiment aims to enrich this literature by studying the effect of likelihood insensitivity and pessimism.

3 Experimental design

The experiment consists of different tasks: the donation task (main task), which is a dictator game, to measure altruistic behavior, and different elicitation tasks of risk and ambiguity attitudes, which differ according to the different treatments. We will hereafter describe the main task (subsection 3.1), the different treatments

(subsection 3.2), and how we elicit risk and ambiguity attitudes (subsection 3.3).

3.1 The main task: a modified dictator game

The main task of the experiment consists of a modified dictator game, where the senders are the experimental subjects, and the receivers are represented by environmental NGOs. At the very beginning of the experiment, participants are told they will have to decide whether or not they would like to make donations to an NGO. They are then asked to choose between three environmental-related NGOs: i) WWF (World Wide Fund for Nature), ii) Greenpeace, and iii) Zero Waste France. Participants are also provided with a description of each NGO[2] and are told that the NGOs will effectively receive their given amount a few days after the experimental session, for which they will receive a tax receipt.

After choosing the NGO, each participant is endowed with 100 ECUs (Experimental Currency Units). Participants are then asked whether they would like to donate to the chosen NGO. They can choose an amount x between 0 and 100 ECUs. The participants keep the amount they decided not to donate, which is $100-x$ECUs. Note that each participant can decide not to donate ($x = 0$);

3.2 The treatments

The experiment includes one control group and three treatment groups, which modulate the level of risk and ambiguity applied to the donations. We used a between-subject design where the participants were randomly assigned to one of the four groups. In the following subsections, we present the *Control* group, the *Risk* Treatment (RT), the *Low Ambiguity* Treatment (LAmbT), and the *High Ambiguity* Treatment (HAmbT)[3].

3.2.1 Control group

In the Control group, there is no uncertainty. It is based on a dictator game where the amount donated to the NGO is multiplied by 1.2.

In the following subsections, we describe the three treatment groups. In those groups, participants always face an urn with three types of colored marbles (purple, blue, and orange) that would lead to three possible events, each determining the

[2]WWF focuses on wildness preservation and the reduction of human impact on the environment; Greenpeace seeks to ensure the ability of the earth to nurture life in all its diversity, and Zero Waste France promotes the zero waste approach in Paris and Ile-de-France

[3]Instructions for the HAmbT can be found in Appendix B

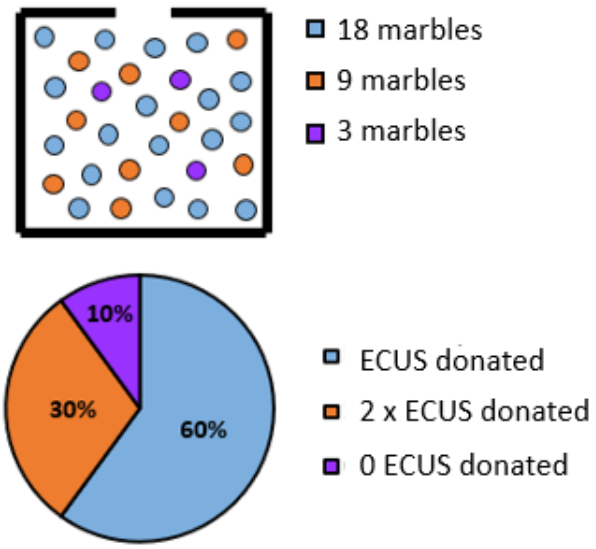
amount received by the NGOs. The three possible events are: i) A purple marble is drawn: the NGO does not receive anything from the participant (i.e., the donation is destroyed), ii) A blue marble is drawn: the NGO receives the exact amount given by the participant, iii) An orange marble is drawn: the NGO receives twice as much as the mount given by the participant.

In the Risk Treatment, participants know the exact number of each colored marble in the urn. In ambiguity treatments, participants do not know about the whole distribution of the marbles.

3.2.2 Treatment 1: Risk Treatment (RT)

The Risk Treatment introduces risk in the donations received by the NGO: participants are told that with a 10% probability, the NGO will not receive the donation (purple marble); with a 60% probability, the NGO will receive the exact amount given by the participant (blue marble); and with a probability of 30%, the NGO will receive twice the amount given by the participant (orange marble). In this treatment, participants face an urn composed of 18 blue marbles, nine orange marbles, and three purple marbles. Figure 1 shows what the participant actually saw on their screen as insctructions for the task before the decision to donate or not was made.

Figure 1: Donations under the risk treatment



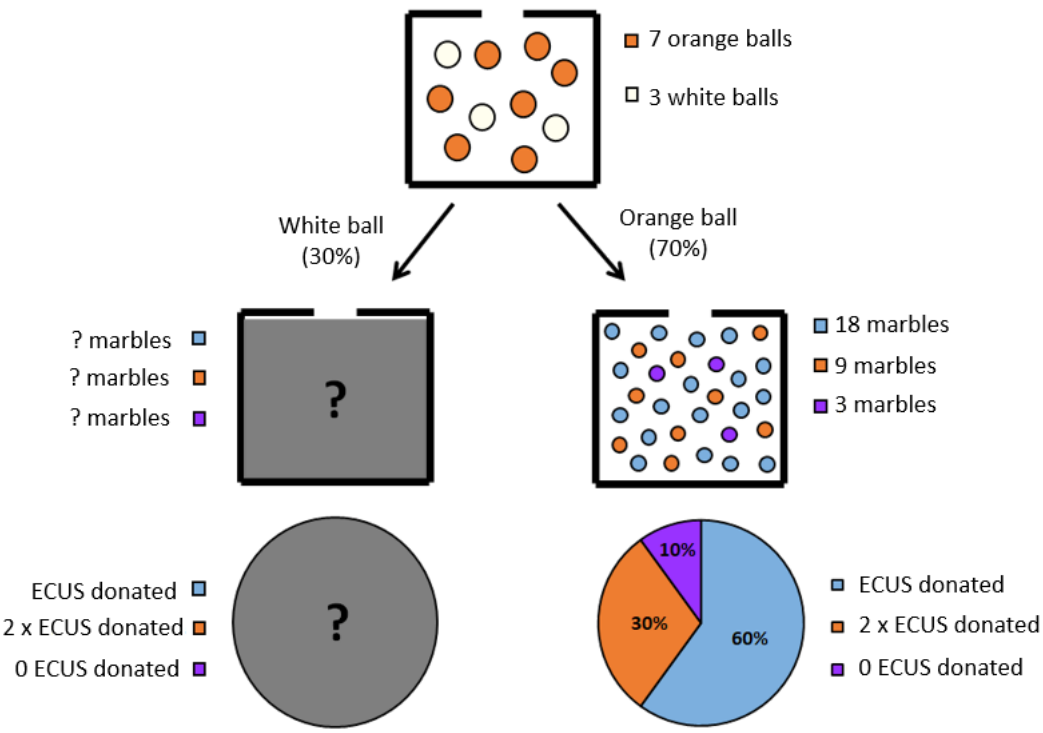
At the end of each RT session, a volunteer participant drew a marble in an opaque urn without looking. The drawn marble would determine the event for each

participant: if the purple marble is drawn, the NGO will not receive anything at all; if the blue marble is drawn, the NGO receives exactly the amount donated by each participant of the session; and finally, if the orange marble is drawn, the NGO receives the twice the amount donated by each participant.

3.2.3 Treatment 2: Low Ambiguity Treatment (LAmbT)

The Low Ambiguity Treatment introduces ambiguity in the donations received by the NGO. As opposed to the RT, participants do not know about the whole distribution of probabilities associated with each possible event. Participants are told that with a 70% probability, they know about the distribution of probabilities to the realization of each possible event. The distribution is the same as in the RT. And they are told that with a 30% probability, they do not know about the distribution of probabilities associated with the realization of each possible event. In this case, participants are under complete uncertainty. Figure 2 shows the lottery participants face under LAmbT.

Figure 2: Lottery under low ambiguity treatment



At the end of each LAmbT session, and to implement ambiguity, participants face two urns. The first urn comprises ten balls: seven orange balls and three white

balls. A volunteer participant randomly draws a ball.

- If an orange ball is drawn, the experimenter composes an urn with known probabilities, as in the RT. And a second participant would draw a ball in this second opaque urn that would determine the event for the NGO.
- If a white ball is drawn, an urn with unknown probabilities is composed. First, the experimenter mixes an opaque urn with 30 blue marbles, 30 orange marbles, and 30 purple marbles. In this case, a second volunteer participant randomly draws, without looking, 30 marbles from the urn composed of 90 marbles to create the urn with unknown probabilities. Finally, a third volunteer participant randomly draws from the urn with unknown probabilities a marble for which the color would determine the payoff to the NGO.

3.2.4 Treatment 3: High ambiguity treatment (HAmbT)

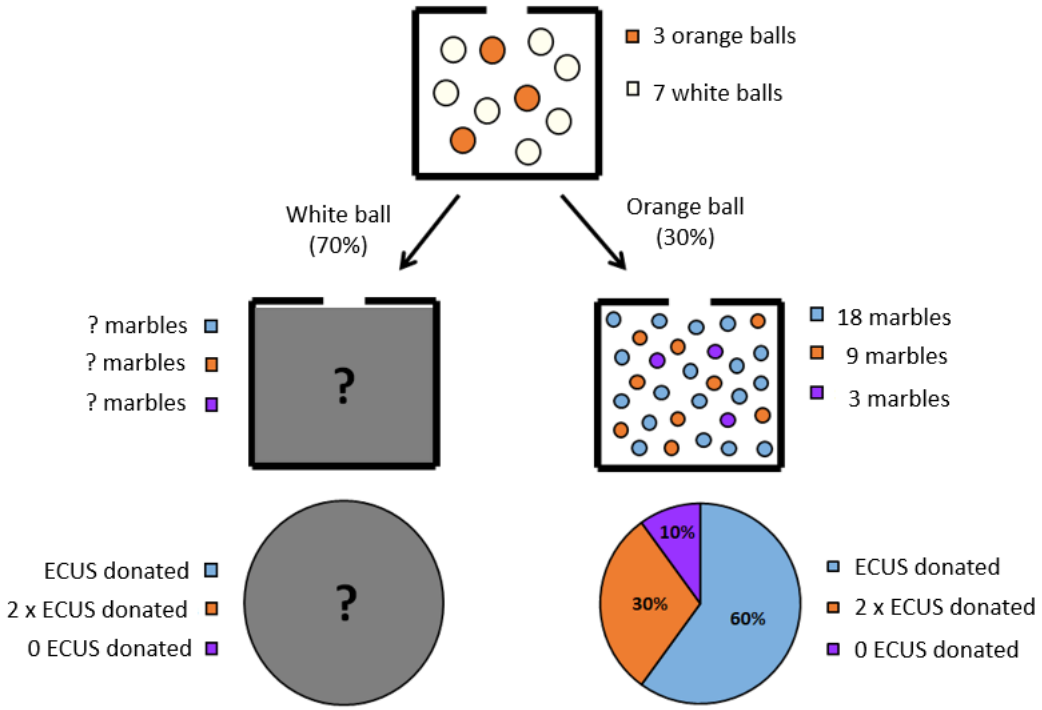
The third treatment is the High Ambiguity Treatment. We call this treatment "high ambiguity" in opposition to the LAmbT. However, participants in this treatment do not face full ambiguity, they still face partial ambiguity as in the LAmbT. Subjects know the exact distribution of the probabilities of each event with a 30% probability. And with a 70% probability, participants are in complete uncertainty. Figure 3 shows the lottery faced by the participants in the HAmbT.

3.3 Elicitation of risk and ambiguity attitudes

As in the LAmbT, at the end of each HAmbT session, and to implement ambiguity, the same drawing procedure occurs except that the first urn is composed of seven white balls and three orange balls. Hence, if an orange ball is randomly drawn, the urn with unknown probabilities is composed; if a white ball is randomly drawn, then the urn with known probability is composed.

We elicit levels of risk aversion and ambiguity aversion, likelihood insensitivity, and pessimism to study their effect on charitable giving. First, we elicit risk aversion and unframed ambiguity attitudes, the tasks appear randomly before the donations task. Then, we elicit framed ambiguity attitudes and excuse-driven behavior, the tasks appear randomly after the main task.

Figure 3: Lottery under high ambiguity treatment



3.3.1 Elicitation of risk aversion

In all treatment and control groups, risk aversion is elicited using the Holt and Laury (2002) method. Participants face ten pairs of lotteries (see Figure 4. They are asked to choose the lottery they prefer between lottery A and lottery B. Lottery A represents a safer lottery choice (winning 20 ECUs vs. winning 16 ECUs). Meanwhile, lottery B is riskier (winning 38.5 ECUs vs. 10 ECUs). The probability of winning the favorable payoff increases for each pair of lottery (therefore, the probability of winning the unfavorable payoff also changes). The later the participant switches from lottery A to lottery B, the more the participant is risk averse, and its coefficient of relative risk aversion would increase. Participants could only switch once from lottery A to lottery B.

3.3.2 Elicitation of ambiguity attitudes

Ambiguity aversion and likelihood insensitivity are elicited following the Baillon et al. (2018) method. We elicit matching probabilities for each single and composite events such that a matching probability of an event is defined as the probability m when the individual is indifferent between receiving an amount X if the event occurs or receiving X with probability m.

Figure 4: Screenshot of the risk aversion elicitation task

TABLEAU 1	LOTERIE A					LOTERIE B			
Décision	Probabilité	Gain (ECUS)	Probabilité	Gain (ECUS)	Loterie préférée	Probabilité	Gain (ECUS)	Probabilité	Gain (ECUS)
1	10%	20	90%	16	○ Loterie A ○ Loterie B	10%	38.5	90%	10
2	20%	20	80%	16	○ Loterie A ○ Loterie B	20%	38.5	80%	10
3	30%	20	70%	16	○ Loterie A ○ Loterie B	30%	38.5	70%	10
4	40%	20	60%	16	○ Loterie A ○ Loterie B	40%	38.5	60%	10
5	50%	20	50%	16	○ Loterie A ○ Loterie B	50%	38.5	50%	10
6	60%	20	40%	16	○ Loterie A ○ Loterie B	60%	38.5	40%	10
7	70%	20	30%	16	○ Loterie A ○ Loterie B	70%	38.5	30%	10
8	80%	20	20%	16	○ Loterie A ○ Loterie B	80%	38.5	20%	10
9	90%	20	10%	16	○ Loterie A ○ Loterie B	90%	38.5	10%	10
10	100%	20	0%	16	○ Loterie A ○ Loterie B	100%	38.5	0%	10

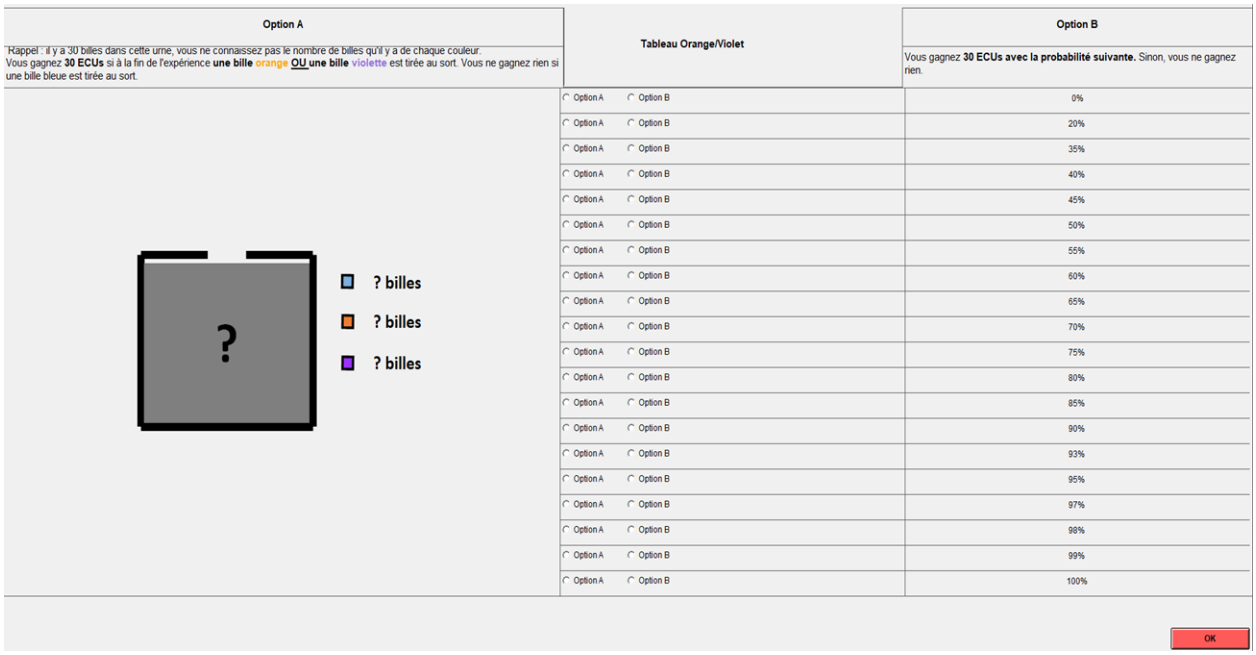
OK

In the control and RT groups, we elicit likelihood insensitivity and ambiguity aversion only once within an unframed setup (not contextualized). In LAmbT and HAmbT groups, they are elicited twice: once within an unframed setup, as in the two other groups, and once within a framed one (contextualized). We elicit framed, unframed ambiguity attitudes since Baillon et al. (2018, 2021) claim that ambiguity attitudes are context dependent.

3.3.3 Unframed elicitation of ambiguity attitudes

After determining the event of the donation, thanks to the randomly chosen urn using the probabilities associated with each treatment, we would create a second urn. This urn was also constituted of 30 colored marbles; blue, orange, and purple. However, participants would not know the number of marbles for each color (unknown probabilities). To elicit ambiguity attitudes, we used the method of Baillon et al. (2018). First, we would elicit six matching probabilities: one for every single event and one for every composite event. There were three single events: to draw a blue, orange, or purple marble randomly. And three composite events: to randomly draw a blue or an orange marble, to randomly draw a blue or a purple marble, and to randomly draw an orange or a purple marble.

Figure 5: Screenshot of the unframed elicitation task

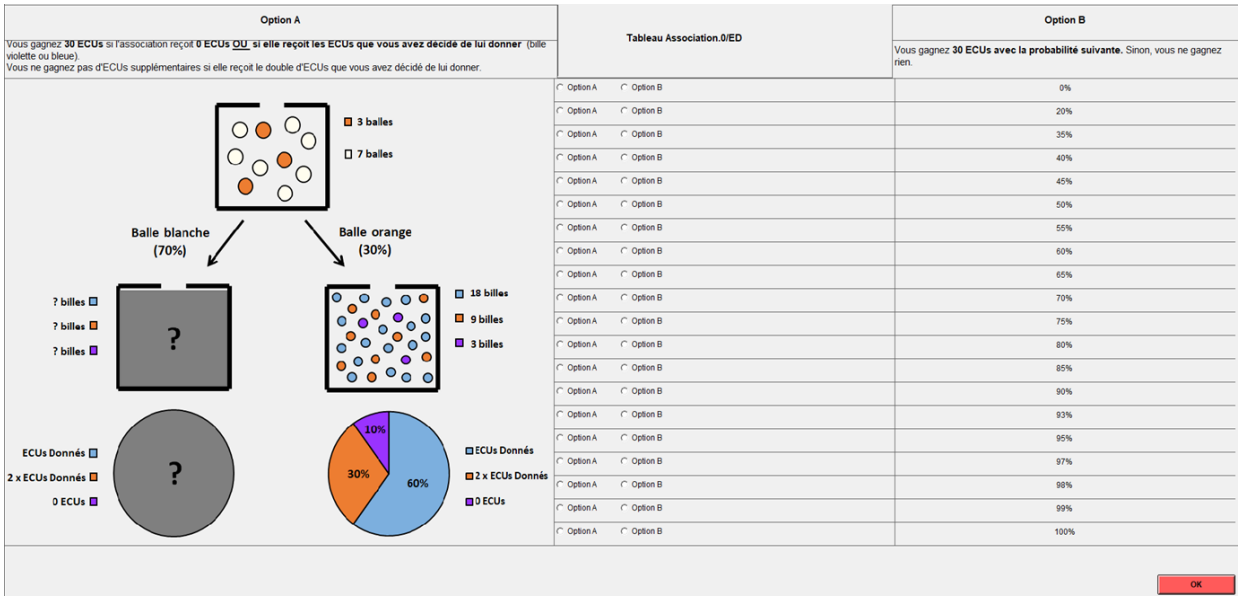


Subjects face six tables that appeared in a random order, each composed of 20 decisions. They had to choose the option they preferred between option A and option B. Option A was the same for every table: The participant could win 30 ECUs if the blue/orange/purple (depending on the presented table) were randomly drawn. If the subject chose option B, she could win 30 ECUs with a probability of p (or win 0 ECUs with a probability of 1-p). Figure 5 is a screenshot of one of the six tables for the composite event "to draw an orange or purple marble randomly".

To elicit the matching probability of a specific event, we calculated the sum of the probabilities associated with the decision before and after the switching point (between option A and option B) and divided it by two to obtain a more precise estimation of the matching probability.

Since in this task, participants faced full ambiguity (i.e., they did not possess any information about the number of marbles in the urn for each color), (unframed) ambiguity attitudes were always elicited before the donation task (main task) before the participants knew the distribution of probabilities associated to donations. Therefore, the individuals were not contaminated by any beliefs about the probability distribution.

Figure 6: Screenshot of the framed elicitation task under HAmbT



3.3.4 Framed elicitation of ambiguity attitudes

To elicit framed ambiguity attitudes, we used once again the method ofBaillon et al. (2018). We replicated a second time the same task for subjects in the LAmbT and HAmbT after the donation task. In this task, we elicit ambiguity attitudes for the exact level of ambiguity that participants faced in the main task. Since control and RT participants did not face ambiguity in the donation task, we could not elicit their framed ambiguity attitudes. In the framed setup, individuals did not face any more full ambiguity when choosing between options A and B, they faced partial ambiguity and the exact probability distribution as the one presented in the main task.

In order to elicit framed ambiguity attitudes, subjects faced six tables appearing in random order, one for each matching probability (three for single events and three for composite events). They had to choose the option they preferred between option A and option B. The three single events in this context are: the NGO receives 0 ECUs; the NGO receives the ECUs donated; the NGO receives double the amount donated. The three composite events are: the NGO receives either 0 ECUs or the amount donated; the NGO receives either 0 ECUs or double the amount donated; the NGO receives either the amount donated or double the amount. Each event possessed the exact probabilities as in the main task, depending on the treatment.

These matching probabilities allow us to elicit an ambiguity aversion index, a likelihood insensitivity index, and, thanks to the first two indexes, a pessimism index. The matching probability of an event will depend on the subjective belief

of the decision maker in the event and on her ambiguity attitude. Figure 6 is a screenshot of one of the six task tables for eliciting the matching probability of the composite event "the NGO will receive 0 ECUs or the NGO will receive the amount donated".

The ambiguity aversion index (b) is calculated from the following equation:

$$b = 1 - \bar{m}_c - \bar{m}_s$$

The insensitivity index (a) is:

$$a = 3 \times (\frac{1}{3} - (\bar{m}_c - \bar{m}_s))$$

Where $\bar{m}_c$ corresponds to the average composite-event matching probability of the composite events' matching probabilities, and $\bar{m}_s$ corresponds to the average single-event matching probability.

Under ambiguity neutrality $\bar{m}_s = \frac{1}{3}$ and $\bar{m}_c = \frac{2}{3}$, hence $a = 0$ and $b = 0$. The indexes are normalized so that the maximal value is 1. An ambiguity-averse individual will have a positive ambiguity aversion index; for an extreme ambiguity-averse individual, her ambiguity aversion index will be equal to 1. Ambiguity lovers will have a negative aversion index. The likelihood insensitivity index is defined as the lack of discriminatory power of the decision maker regarding different levels of likelihood (Li, Turmunkh and Wakker, 2019) or perception of the level of ambiguity. If the subject discriminates between composite and single events, the smaller the insensitivity index is. This index is usually positive. However, there are some subjects with $a < 0$ (sensitive individuals), which is desirable to include in our analysis (as explained in Baillon et al. (2018)).

Thanks to the indexes above, we are able to obtain a pessimism index (α), following Baillon et al. (2021):

$$\alpha = \frac{b}{2a} + \frac{1}{2}$$

This index represents the individual's belief about the probability of the event "the NGO will receive 0 ECUs". A pessimistic individual will assign a high probability to the realization of this event; in this case, her pessimism parameter will be close to 1. On the contrary, if the individual is optimistic, she will assign a low probability to the worst possible event, "the NGO will receive 0 ECUs"; her parameter will be close to 0.

3.4 Eliciting excuse-driven behavior and additional questions

When introducing risk or ambiguity to donations, it creates situations that decrease the guilt of not being altruistic. This may lead to a "moral wiggle room" for individuals to behave less altruistically. It has been proven that introducing risk or ambiguity reduces donations because of this moral wiggle room, as shown in Exley (2016) and in Garcia, Massoni and Villeval (2020). Proving that the individual is less altruistic when confronted with uncertainty. In this experiment, we controlled for this effect by using a modified method of elicitation (Garcia, Massoni and Villeval, 2020). We included two price lists to take into account any excuse-driven behavior.

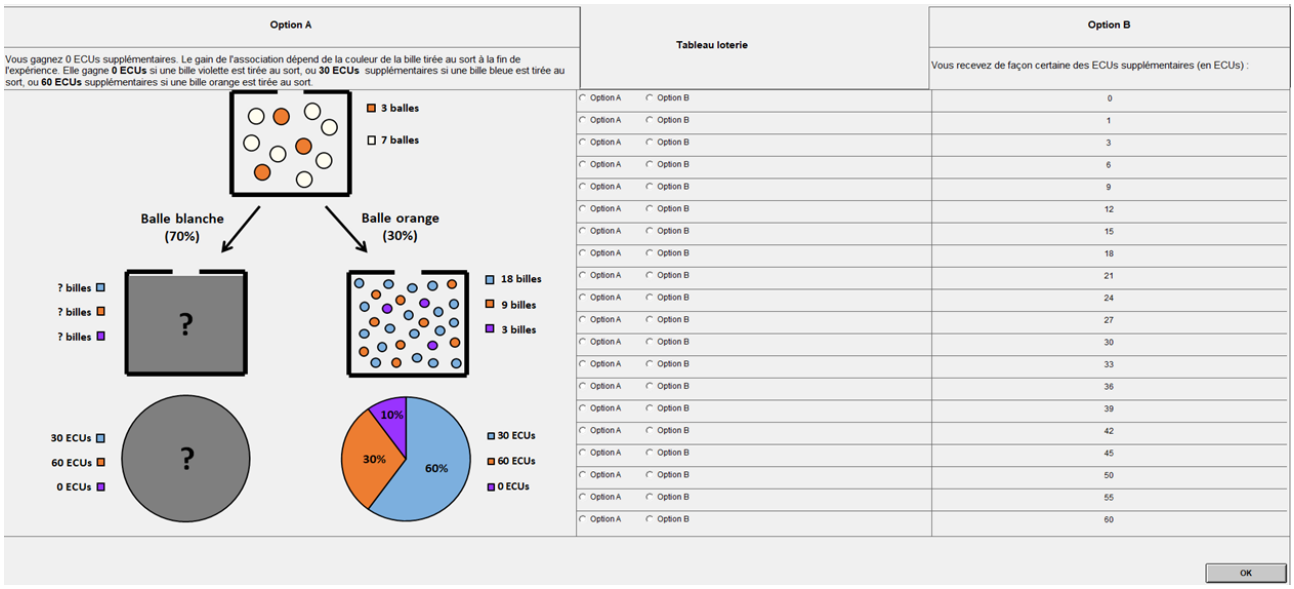
In one table (charity table), participants faced 20 decisions, and they had to choose the option they preferred between option A and option B. Option A was the same across the 20 decisions: a lottery for the NGO; this lottery gave the NGO an additional payoff of either 0, 30 ECUs, or 60 ECUs. Option B: a safe payoff for the NGO.

In the other table (self table), participants also faced 20 decisions and also had to choose the option they preferred between option A and option B. Option A stayed the same as in the charity table. However, option B was a safe payoff for the subject. In both tables, subjects could not switch back and forth and could not switch from option B to option A. The tables appeared randomly. In the two tables, the safe payoff goes from 0 ECUs to 60 ECUs.

Since this behavior only appears when there is uncertainty, we did not include this task in the control group. This task was different for every treatment (RT, LAmbT, and HAmbT), the lottery for each treatment in this task possessed the exact probabilities as in the main task for each treatment to measure a possible excuse-driven behavior in the same setup when the subjects made their giving decisions. However, the events were not the same. Figure 7 is a screenshot of the self table under HAmbT.

Charity-valuation corresponds to the safe payoff of the switching point from option A to option B in the charity table. Self-valuation corresponds to the safe payoff of the switching point from option A to option B in the self table. For an individual with excuse-driven preferences, the charity valuation is above the self-valuation (Garcia, Massoni and Villeval, 2020). Therefore, we only calculated the difference between charity-valuation and self-valuation to have a simplified measure of excuse-driven behavior.

Figure 7: Screenshot of the excuse-driven behavior task under HAmbT: self table



Finally, participants had to answer a survey that included socio-demographic questions: age, sex, income, and level of education. They also had to answer a questionnaire that measures environmental attitudes, the NEP scale (New Environmental Paradigm scale) (Dunlap et al., 2000) to control any pro-environmental behavior since charities were environmental NGOs. We also controlled for previous donation behaviors: such as if the participant has previously donated, the amount they usually donate, and the frequency.

3.5 Experimental procedures

The experiment was conducted at the "Laboratoire d'Economie Expérimentale de la Défense" (Courbevoie, France). We obtained the approval of the ethics committee of the University of Paris Nanterre (CER-PN). 218 individuals took part in the experiment and were randomly assigned to one of the four treatment groups: 53 participants were assigned to the control group, 53 were assigned to RT, 54 were assigned to LAmBT, and 58 to HAmbT. Sessions took place in April, June, and November 2022. 81 subjects were male (39.90%), and three participants did not inform about their gender (1.49%). Their average age was 37.75 years old, and 35.32% were students. The experiment was developed using z-Tree (Fischbacher, 2007).

The analysis is run on a total of 203 subjects since 15 of them (6.8%) made non-consistent decisions in the framed elicitation task of ambiguity attitudes: they

did not exhibit a switching point between option A and option B for more than three tables in the framed elicitation task, i.e., they only chose option A or only chose option B in more than three tables associated to the matching probabilities of the single events.

The experiment was incentivized using the prior incentive system PRINCE (Johnson et al., 2021), to avoid any strategic behavior from individuals conceiving the set of decisions as a meta-lottery and not considering each decision independently; this might happen in matching. The experiment contains a certain number of decisions y in total (by adding all decisions from all elicitation tables). 140 for the control group, 170 for the RT group, and 290 for the LAmbT and HambT groups. At the beginning of the experiment, each participant had to pick and enter a number between 1 and the corresponding y. This chosen number was previously randomly paired with one of the decisions of the experiment. The decision randomly associated with the chosen number was implemented to determine the additional payoff. At the end of the experiment, we gave the participants an envelope with a table inside where they could verify that the decision implemented corresponded to the number they chose at the beginning of the experiment.

The session lasted, on average, one hour and fifteen minutes. The average payoff was €14.66 (including a show-up fee of €7), and the average donations were €2.83. All participants received their payoff privately in cash at the end of the experiment.

Individuals' payoff depended on the main task and on one of the elicitation tasks. The participants received at the beginning of the experiment 100 ECU (100 ECUs = €7.5), and they kept the money that they didn't decide to donate. Donations to charities were effectively made, and each individual received proof of their donation and a tax receipt directly issued by the NGO. As explained above, besides the payoff of the main task, one of the decisions of the experiment in one of the elicitation tasks was randomly chosen to determine the additional payoff.

4 Predictions

Our experiment aims at testing five main hypotheses that will help fill gaps in the literature on the role of uncertainty in charitable giving. The first hypothesis is based on the level of donations of each treatment.

Hypothesis 1 *Donations under risk will be lower than donations under no-uncertainty.*

The first assumption is taken from the literature. Krawczyk and Le Lec (2010); Brock, Lange and Ozbay (2013); Freundt and Lange (2017); Cettolin, Riedl and Tran (2017) and Exley (2016) find that donations decrease under risk compared to no uncertainty.

Hypothesis 2 *The introduction of any level of ambiguity will decrease donations compared to risk.*

As explained in section 2, the existing literature finds different results regarding donations under risk compared to ambiguity. This hypothesis seeks to add evidence to the literature.

Hypothesis 3 *Donations under low ambiguity are higher than donations under high ambiguity.*

This hypothesis follows hypotheses 1 and 2: an increase in uncertainty leads to a decrease in mean donations. In the literature, there is no evidence of the difference between different levels of ambiguity on donations. Only Garcia, Massoni and Villeval (2020) do not find any differences in excuse-driven behavior between partial and full ambiguity.

The following hypothesis focuses on risk, ambiguity attitudes, and pessimistic beliefs.

Hypothesis 4 *Ambiguity (risk) aversion will decrease donations under ambiguity (risk).*

A more risk-averse individual should decrease their donations, following results from (Cettolin, Riedl and Tran, 2017). Moreover, ambiguity aversion should also have a negative effect on donations under ambiguity. The more ambiguity averse the individual is, the more she will dislike ambiguity and the fewer donations she will give.

Hypothesis 5 *Pessimism will decrease donations*

The more pessimistic an individual is, the less she will donate under ambiguity. Implying that the overweighting of the probabilities of low payoffs and underweighting the probabilities of high payoffs have a negative impact on donations. This hypothesis has not yet been tested experimentally.

5 Results

We present the different results in this section.

Table 1 presents summary statistics of the main control variables used in our analysis.

15 participants were excluded from the experiment. We could not compute their matching probabilities under the framed setup in the ambiguity attitudes elicitation task. These individuals preferred more than three times option B in the first decision of each table (option A: winning 30 ECUs if the specified event in the table occurs vs. option B winning 30 ECUs with a probability of 0%); or they preferred more than three times option A in the last decision of each table (option A: winning 30 ECUs if the specified event in the table occurs vs. option B winning 30 ECUs with a probability of 100%). This behavior is most likely to be due to misunderstanding of the instructions than to non-rationality. We decided not to exclude individuals that did not switch between option A to option B for only one table since allowing us to include "irrational" behavior to some extent.

We first study the effect of risk and ambiguity on the level of donations (subsection 5.1). We then, show the results on the effect of ambiguity attitudes on donations (subsection 5.2).

Table 1: Summary statistics

		Treatments			
Variables	All	Control	RT	LAmbT	HAmbT
Age	37.63	36.2	36.9	40.16	37.42
Gender					
- Female (%)	58.13	52.83	50.94	67.35	62.5
- N/A (%)	2.00	0.00	0.00	4.08	4.17
Previous donation to an NGO (%)	69.95	73.56	71.70	65.30	68.75
NEP score	44.00	43.71	45.7	43.14	44.92
Student (%)	35.47	35.85	39.62	30.61	35.42
Monthly income					
- Less than 800 € (%)	29.06	28.30	32.09	24.49	31.25
- From 800 to 1200 € (%)	15.27	9.44	20.75	14.29	16.67
- From 1200 to 1800 € (%)	21.68	30.19	15.09	24.49	16.67
- From 1800 to 2500 € (%)	10.35	3.77	15.09	8.16	14.58
- Above 2500 € (%)	9.85	7.55	7.55	16.33	8.33
- N/A (%)	13.79	20.75	9.43	12.24	12.5
# of observations	203	53	53	49	48

Notes: NEP score is comprised between 0 and 60, the score measures pro-environmental attitudes. Previous donations to an NGO is a dummy variable = 1 if the participant has already donated to a NGO, and = 0 if not.

5.1 The effect of risk and ambiguity on the levels of donations

We represent in Figure 9 the average donation levels in the different treatment groups. The average donation in the control group is 26.25 ECUs (s.d. = 30.6); in the Risk treatment it is 24.7 ECUs (s.d. = 25); in the LAmbT, the average is 29.4 ECUs (s.d. = 28.2), and in the HAmbT it is 17.7 ECUs (s.d. = 24.2). We do not observe any significant differences in donation levels between the control and the different treatment groups. Hypothesis 1 is not verified, we do not find any significant difference between the control group and RT (a Wilcoxon test yields a p-value= 0.550).

Result 1: There is no difference in donations between no-uncertainty and risk.

In Figure 9, we observe an increase in the level of donations in LAmBT, compared to risk, however, the difference is not significant (Wilcoxon test, p-value= 0.246. On the contrary, we observe a significantly lower level of donations between HAmbT and RT (a Wilcoxon test yields a p-value= 0.045). We can conclude that hypothesis 2 is partially fulfilled.

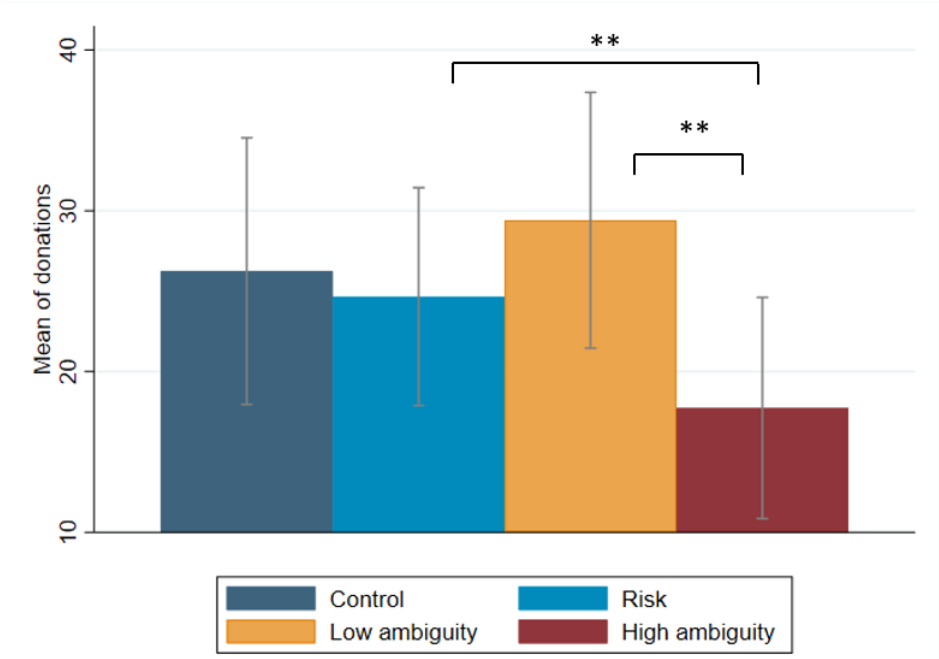
Result 2 : The introduction of a low level of ambiguity does not decrease nor increase donations compared to risk. A high level of ambiguity decreases donations.

We can also observe in Figure 9 a decrease of donations in HAmbT compared to LAmbT (a Wilcoxon test yields a p= 0.017). This figure hence shows that donations were lower in the context of higher levels of ambiguity, confirming hypothesis 3. This result is confirmed by Figure 9. The figure shows the probability density function of donation levels in each treatment. What stands out in this figure is that the probability of the donations being smaller than 20 ECUs is higher for the HAmbT, followed by the RT. This indicates that individuals tend to be less altruistic in a high-ambiguity environment than in a low-ambiguity or no-uncertainty environment.

Result 3: A high level of ambiguity decreases donations compared to a lower level of ambiguity.

We run an OLS regression on the amount of donations to NGOs as shown in Table 2. Column (1) confirms the results previously discussed such that there is no impact of risk, low ambiguity, or high ambiguity on donations compared to the control group. When adding control variables in Column (2), we confirm that we do not find any treatment effects. Control variables include age, gender, income if the individual has previously donated to an NGO, and her pro-environmental

Figure 8: Mean of donations per treatment



Notes: Stars represent the level of significance for Mann Whitney U Test. ***p < 0.01, **p < 0.05, p* < 0.1. Grey lines correspond to 95% confidence intervals.

Figure 9: Kernel density estimation of donations per treatment

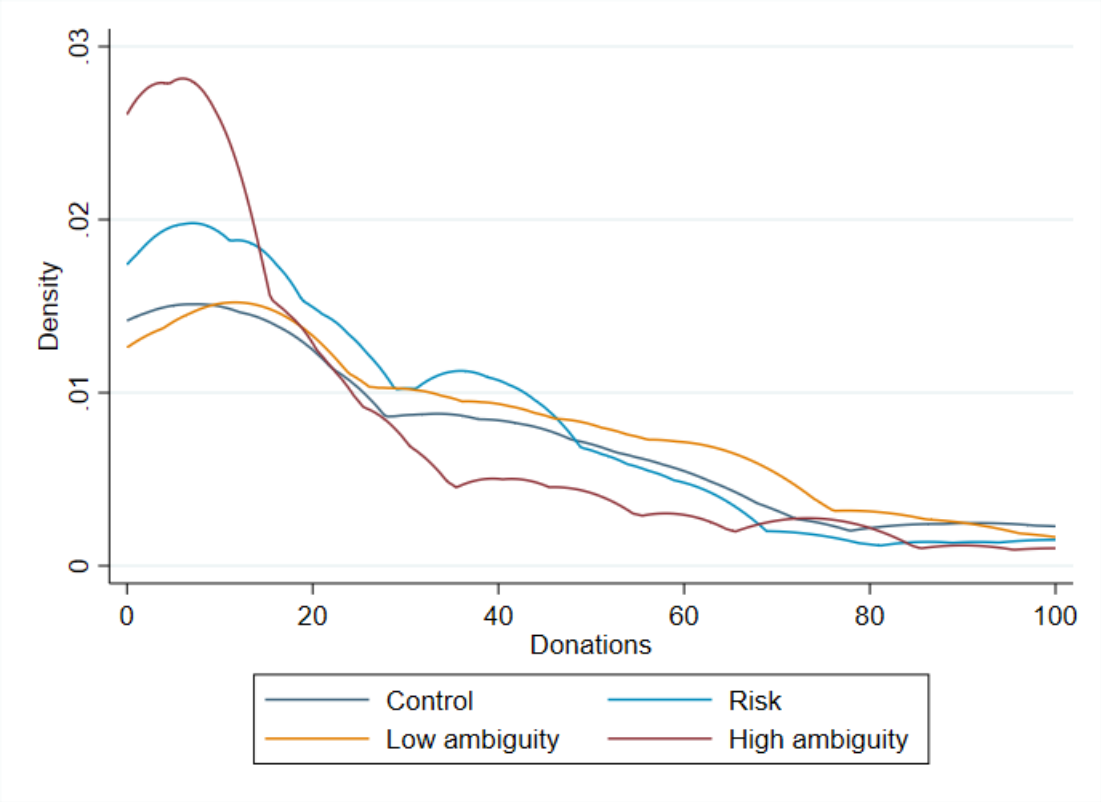


Table 2: OLS regression on the determinants of the level of donation

	(1)	(2)
RT	-1.58	2.12
	(5.43)	(5.36)
LAmbT	3.16	3.94
	(5.83)	(5.50)
HAmbT	-8.52	-5.22
	(5.47)	(5.44)
Age		-0.15
		(0.16)
Gender, ref. male		
Female		9.96***
		(3.60)
Gender, N/A		-14.80***
		(4.48)
Income, ref. Less than 800 €		
Income, From 800 to 1200 €		-3.26
		(5.09)
Income, From 1200 to 1800 €		19.38***
		(7.36)
Income, From 1800 to 2500 €		-4.86
		(6.47)
Income, Above 2500 €		2.66
		(7.03)
Income, N/A		-5.72
		(5.89)
Previous donations to an NGO		3.39
		(4.06)
NEP score		-0.01
		(0.26)
Risk aversion coefficient		-1.67
		(3.93)
Constant	26.25***	19.30
	(4.21)	(12.05)
Observations	203	203
R-squared	0.02	0.18

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable is the level of donations (continuous variable between 0 and 100). 4 participants (1.97%) did not want to share their gender. 28 participants (13.8%) did not want to share their income. LAmbT and HambT are the treatment dummy variables. The risk aversion coefficient corresponds to the CRRA coefficient estimated with the Holt & Laury measure (the higher, the more risk averse). The NEP score is a continuous variable and a measure of environmental attitudes. The variable previous donations to an NGO is a dummy variable = 1 if the participant has already donated to an NGO, and = 0 if not.

preferences (NEP score).

By looking at this regression, we can also confirm the gender effect regarding donations found in the literature (Eckel and Grossman, 1998), such as women give more than men. We also find that participants with an income between €1200 and €1800 give more than participants with an income below €800. We do not find any effect of age on donations. Finally, we do not find any effect of pro-environmental preferences on donations.

5.2 Ambiguity attitudes and donations

Table 3 shows the results using OLS regressions with unframed ambiguity attitudes, where the dependent variable is the level of donations while controlling for ambiguity attitudes (unframed ambiguity aversion, likelihood insensitivity, and pessimism). To study ambiguity attitudes, in these regressions, we only include ambiguity treatments (LAmbT and HAmbT) since ambiguity attitudes only have an impact on behavior under an ambiguous environment. We excluded 15 participants in addition to those already excluded (hence N=82) to run these regressions, following the same method explained in 3.3.4. We excluded these participants since their decisions seem to indicate that they did not understand the (unframed) ambiguity attitudes task.

Column (1) shows that (unframed) likelihood insensitivity has a positive effect on donations (significant at a 1% level). However, when adding the control variables to the regression (column (2)), it is no longer significant. Columns (3) and (4) show that there is no impact of unframed pessimism on donations[4]. Finally, Columns (1) and (3) show that HAmbT yields a negative effect on donations (compared to LAmbT). However, the treatment effect disappears when adding controls to the regressions. These results seem to indicate that ambiguity attitudes do not have any effect on donations in ambiguity environments. However, in Table 3, we only focused on unframed ambiguity attitudes.

Ambiguity attitudes depend on sources of uncertainty (Baillon et al., 2018, 2021). They are context dependent and do not stay constant across different environments and levels of ambiguity. Hence, it is interesting to focus on analyzing the impact of (framed) ambiguity attitudes on donations per treatment (i.e., on specific environments and levels of ambiguity). Moreover, focusing on risk and ambiguity attitudes

[4]Note that we do not include ambiguity aversion, likelihood insensitivity, and pessimism in the same regression since the parameter pessimism is constructed from ambiguity aversion and insensitivity.

will allow studying the impact of these different variables according to a specific environment.

Table 3: Impact of ambiguity attitudes on donations

	(1)	(2)	(3)	(4)
HAmbT	-13.88**	-8.65	-13.59**	-7.62
	(5.74)	(5.64)	(5.98)	(5.81)
(Unframed) ambiguity aversion	2.38	2.12		
	(9.33)	(10.44)		
(Unframed) insensitivity	16.41***	10.62		
	(6.19)	(6.81)		
Risk aversion coefficient	-4.31	-8.82	-3.24	-9.43
	(5.75)	(5.77)	(6.45)	(6.39)
(Unframed) pessimism			-2.02	11.69
			(24.53)	(25.06)
Constant	22.19***	11.41	30.67**	8.06
	(5.55)	(20.39)	(13.23)	(21.13)
Controls	No	Yes	No	Yes
Observations	82	82	82	82
R-squared	0.14	0.07	0.31	0.29

Robust standard errors in parentheses. Reference is LAmbT
*** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions. The dependent variable is the level of donations and is a continuous variable between 0 and 100. HAmbT is a dummy variable = 1 when it is the high ambiguity treatment and equal to 0 when it corresponds to the low ambiguity treatment. Unframed ambiguity attitudes are continuous variables that measure attitudes under full uncertainty. Ambiguity aversion and likelihood insensitivity are continuous variables comprised between -1 and 1. The higher the ambiguity aversion coefficient, the more ambiguity averse is the participant. If the index is negative, the participant is ambiguity lover. The higher the insensitivity index, the more insensitive to likelihood variations is the participant. The risk aversion coefficient corresponds to the CRRA coefficient estimated with the Holt & Laury measure (the higher the more risk averse). Pessimism is a continuous variable between 0 and 1, where 0 indicates extreme optimism and 1 extreme pessimism. Controls include age, gender, previous donation to an NGO, NEP score, income.

5.2.1 Risk treatment

Table 4 presents two regression analysis taking only into account the risk treatment (N=53). We seek to understand under a risky environment which factors have an effect on donations. Column (1) shows no effect of risk aversion on donations (p-value= 0.12). However, while adding controls, the parameter becomes significant: risk aversion has a positive impact on donations. This is a counter-intuitive result. However, some papers find the same effect (Cettolin, Riedl and Tran, 2017; Fahle and

Sautua, 2021). This result contradicts hypothesis 4, where we assumed risk aversion decreases donations under risk, however, we find that it increases donations.

Table 4: Risk attitudes on the level of donations under risk

	(1)	(2)
Risk aversion coefficient	13.68	26.09***
	(8.64)	(7.61)
Excuse behavior		-0.11
		(0.19)
Constant	30.51***	28.08
	(4.77)	(18.93)
Controls	No	Yes
Observations	53	53
R-squared	0.05	0.41

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions on the risk treatment subsamble only. The dependent variable is a continuous variable on the level of donations between 0 an 100. The risk aversion coefficient corresponds to the CRRA coefficient estimated with the Holt & Laury measure (the higher the more risk averse). Excuse behavior is a continuous variable such that the higher, the more the participant uses risk as an excuse not to give. Controls include age, gender, previous donation to an NGO, NEP score, and income.

5.2.2 Low ambiguity treatment

In this section, we analyze the effect of ambiguity attitudes. Table 5 presents different regressions under LAmbT, including risk and ambiguity attitudes as explanatory variables. We find that neither ambiguity aversion, likelihood insensitivity, pessimism, nor risk aversion has a significant impact on donations under a "low" ambiguity environment.

This result indicates that at a "low" level of ambiguity, ambiguity attitudes do not seem to matter, and other variables will explain the level of donations. However, we find a negative and significant effect of excuse-driven behavior on donations when there is ambiguity, which confirms Garcia, Massoni and Villeval (2020)'s finding.

5.2.3 High ambiguity treatment

Finally, in this section, we study the impact of ambiguity attitudes under a "high" ambiguity environment. We only include participants belonging to the HAmbT. Table 6 presents OLS regressions under HAmbT, where we analyze the impact of

Table 5: Ambiguity attitudes on the level of donations under low ambiguity

	(1)	(2)	(3)	(4)
(Framed) Ambiguity aversion	6.02	-12.33		
	(17.17)	(20.27)		
(Framed) Likelihood insensitivity	-7.39	-5.16		
	(9.80)	(7.20)		
Risk aversion coefficient	2.19	-9.52	3.92	-9.36
	(13.20)	(14.43)	(12.16)	(15.58)
Excuse behavior	-0.77***	-0.62**	-0.71***	-0.60**
	(0.20)	(0.26)	(0.21)	(0.28)
(Framed) Pessimism			21.12	-34.95
			(41.45)	(51.52)
Constant	34.24***	12.31	19.83	35.08
	(8.71)	(26.10)	(19.65)	(37.62)
Controls	No	Yes	No	Yes
Observations	49	49	49	49
R-squared	0.00	0.01	0.42	0.41

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions using only the low ambiguity treatment. The dependent variable is the level of donations and is a continuous variable between 0 and 100. Framed ambiguity attitudes are continuous variables measured under a low ambiguity environment. Ambiguity aversion and likelihood insensitivity are continuous variables comprised between -1 and 1. The higher the ambiguity aversion coefficient, the more ambiguity averse is the participant. If the index is negative, the participant is ambiguity lover. The higher the insensitivity index, the more insensitive to likelihood variations is the participant. The risk aversion coefficient corresponds to the CRRA coefficient estimated with the Holt & Laury measure (the higher the more risk averse). Excuse behavior is a continuous variable, the higher, the more the participant uses ambiguity as an excuse not to give. Pessimism is a continuous variable between 0 and 1, where 0 indicates extreme optimism and 1 extreme pessimism. Controls include age, gender, previous donation to an NGO, NEP score, and income.

ambiguity attitudes under high ambiguity. Columns (1) and (2) (respectively, with and without controls) show no effect of ambiguity aversion nor likelihood insensitivity on donations. In Column (3), we find that the impact of pessimism on donations is negative and significant. Moreover, when adding controls (Column (4)), pessimism still has a significant effect on donations, beliefs seem to matter more than ambiguity aversion. Finally, all regressions suggest a negative effect of excuse-driven behavior. In these regressions, there is no significant effect of risk aversion.

We do not find any effect of ambiguity aversion under ambiguity. Therefore, we can't prove hypothesis 4.

Result 4: There is no evidence of a negative impact of ambiguity (risk) aversion

under ambiguity (risk). However, risk aversion has a positive effect on donations under risk.

These results suggest that pessimism has a negative impact in a high ambiguity environment. This result partially supports hypothesis 5. Pessimism will play a role in donations only under a high ambiguity environment.

Result 5: There is some partial evidence that pessimism decreases donations.

Table 6: Ambiguity attitudes on the level of donations under high ambiguity

	(1)	(2)	(3)	(4)
(Framed) Ambiguity aversion	-12.32	-8.81		
	(8.05)	(8.11)		
(Framed) Likelihood insensitivity	2.27	0.69		
	(7.50)	(6.20)		
Excuse behavior	-0.38**	-0.46**	-0.35*	-0.40*
	(0.19)	(0.22)	(0.18)	(0.21)
Risk aversion coefficient	1.95	-0.69	1.92	-0.53
	(4.61)	(4.58)	(4.38)	(4.40)
Pessimism			-37.20*	-34.29*
			(18.52)	(18.09)
Constant	17.74***	-22.38	38.05***	-3.94
	(3.77)	(21.31)	(11.28)	(21.49)
Controls	No	Yes	No	Yes
Observations	48	48	48	48
R-squared	0.14	0.17	0.47	0.49

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions using only the high ambiguity treatment. The dependent variable is the level of donations and is a continuous variable between 0 and 100. Framed ambiguity attitudes are continuous variables measured under a high ambiguity environment. Ambiguity aversion and likelihood insensitivity are continuous variables comprised between -1 and 1. The higher the ambiguity aversion coefficient, the more ambiguity averse is the participant. If the index is negative, the participant is ambiguity lover. The higher the insensitivity index, the more insensitive to likelihood variations is the participant. The risk aversion coefficient corresponds to the CRRA coefficient estimated with the Holt & Laury measure (the higher the more risk averse). Excuse behavior is a continuous variable, the higher, the more the participant uses ambiguity as an excuse not to give. Pessimism is a continuous variable between 0 and 1, where 0 indicates extreme optimism and 1 extreme pessimism. Controls include age, gender, previous donation to an NGO, NEP score, and income.

6 Discussion and conclusion

This experiment seeks to study the impact of levels of uncertainty on donations. Our results show that levels of uncertainty do not have any impact on mean donations or the distribution of donations. However, we do find a negative effect of a "high" level of ambiguity on mean donations compared to risk and a "low" level of ambiguity. This result indicates that if we seek to increase altruistic behaviors, we should not excessively focus on decreasing ambiguity, except when ambiguity is high. We also study the impact of ambiguity attitudes on donations.[5] Risk aversion only plays a role in the level of donations in a risky environment. We find a positive effect of risk aversion on donations only under risk (Cettolin, Riedl and Tran, 2017; Fahle and Sautua, 2021). This effect is found since an increase in risk aversion increases the concavity of the utility function of giving. Therefore, if the utility function is more concave, the expected marginal utility of donating will be higher, leading the giver to donate more. Moreover, if the dictator reflects her preferences on the recipients' preferences and there is an increase in risk aversion, she will increase her donation. Moreover, we find that risk aversion does not have an effect under ambiguity, implying that under ambiguity, only ambiguity attitudes have an effect.

We find that pessimism is only correlated with donations under high ambiguity. More than disliking ambiguity, subjective beliefs have an effect on donations. This result indicates that the overweighting of the probabilities of low payoffs and underweighting of the probabilities of high payoffs have a negative impact on donations. This might be explained because a high level of ambiguity may increase the effect of subjective beliefs. On the contrary, when there is a "low" level of ambiguity, subjective beliefs about the probabilities of different events play a minor role, and a low ambiguity level will dampen any effect from subjective beliefs. Therefore, a high level of ambiguity may increase the effect of ambiguity attitudes, such as ambiguity aversion and pessimism leading to a decrease in mean donations. These results suggest that there is a threshold for which ambiguity and ambiguity attitudes have a negative impact on donations. An increase in ambiguity may have an amplifying effect on pessimistic beliefs. If an individual is pessimistic, an increase in ambiguity will reinforce the effect of pessimism, decreasing donations. On the contrary, if an individual is an optimist, an increase in ambiguity will reinforce the effect of optimism, increasing donations. Ambiguity and risk attitudes do not seem to matter under "low" levels of ambiguity, supporting the existence of a threshold or level of

[5] This experiment uses compound lotteries and fails to control for attitudes to compound objective lotteries. However, we control for ambiguity attitudes, and Halevy (2007) shows that attitudes to ambiguity and compound objective lotteries are tightly associated.

uncertainty for which ambiguity attitudes matter.

We do not find any effect of risk on donations nor an excuse-driven behavior under risk, as opposed to the literature (Krawczyk and Le Lec, 2010; Brock, Lange and Ozbay, 2013; Freundt and Lange, 2017). This might be explained because in those studies giving takes the form of lottery tickets for winning a prize. In this paper, it is not the case. We could think that individuals focus more on the amount that they are keeping rather than the amount the NGO will receive. We do not find any significant correlation between the risk aversion coefficient and the unframed ambiguity aversion coefficient, as this result suggests the independence between risk and ambiguity attitudes as found in Attanasi et al. (2014). However, when we focus on framed ambiguity attitudes and risk aversion, we find a negative and small correlation between the risk aversion and the framed ambiguity coefficient (Spearman's $\rho = -0.24$, p-value≤ 0.05).

We find a small and positive correlation (Pearson correlation = 0.21, p-value$\leq$ 0.05) between the framed ambiguity aversion and unframed ambiguity aversion. Even if there is a significant correlation, it is small, supporting the idea that ambiguity aversion is context-dependent. This confirms that the source of information and the context changes the level of ambiguity aversion of an individual. Therefore, this result suggests that it is necessary to elicit framed ambiguity attitudes (as opposed to unframed) since these are more accurate for measuring attitudes toward ambiguity.

We showed that the coefficient relative to excuse behavior between a low ambiguity and a high ambiguity environment is quite similar, suggesting that more ambiguity does not increase the effect of excuse-driven behavior. This result suggests that individuals do not use the increase in the ambiguity level as an excuse to give less, as in Garcia, Massoni and Villeval (2020). The findings indicate that the decrease in donations under high ambiguity is not due to an increase in excuse-driven behavior; rather, it is due to the effect of pessimism. Further research should focus on understanding what level of uncertainty and ambiguity attitudes impact the level of donations.

This paper aims to add evidence to the inconclusive literature about the effect of uncertainty on charitable giving. To the best of our knowledge, there is a lack of studies examining the impact of ambiguity attitudes on charitable giving, with only one paper by Cettolin, Riedl and Tran (2017) looking at the impact of ambiguity aversion. Our paper seeks to address this gap by exploring the effect of ambiguity aversion, likelihood insensitivity, and pessimism on charitable giving. In the context

of donations, we would argue that policymakers and/or NGOs should not necessarily focus on decreasing levels of uncertainty, except if it is extreme cases of ambiguity regarding where the donation will go and if it is socially desirable to increase charitable giving. Further research should focus on studying experimentally the existence of an ambiguity threshold for which ambiguity attitudes have an impact on altruistic behaviors.

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Appendix A New-Environmental Paradigm scale and additional questions

New-environmental paradigm scale (Dunlap et al., 2000)

In this part of the experiment, you will find sentences about the relationship between humans and the environment. For each sentence, indicate if you don't know - if you strongly disagree - if you somewhat disagree - if you strongly agree - if you strongly agree.

1. We are approaching the limit of the number of people the Earth can support.

2. Humans have the right to modify the natural environment to suit their needs.

3. When humans interfere with nature it often produces disastrous consequences.

4. Human ingenuity will insure that we do not make the Earth unlivable.

5. Humans are seriously abusing the environment.

6. The Earth has plenty of natural resources if we just learn how to develop them.

7. Plants and animals have as much right as humans to exist.

8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.

9. Despite our special abilities, humans are still subject to the laws of nature.

10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.

11. The Earth is like a spaceship with very limited room and resources.

12. Humans were meant to rule over the rest of nature.

13. The balance of nature is very delicate and easily upset.

14. Humans will eventually learn enough about how nature works to be able to control it.

15. If things continue on their present course, we will soon experience a major ecological catastrophe.

Behavior related to donations

Have you already donated to an NGO?

[*If the participant answered "yes" to the previous question*]

How often do you donate?

- Several times a year
- Approximately once a year
- Every 2-3 years
- Less than every 2-3 years
- Never

Was the donation(s) directed to an environmental association?

When you make a donation, how much do you give on average (in euros)?

Appendix B High ambiguity treatment instructions

Welcome!

Thank you for agreeing to participate in this experiment! You are participating in an experiment where you can earn money based on your choices. Your earnings will also depend on different events. Each participant makes their decisions individually on their computer.

The answers to these questions are important to us and will be completely anonymous and confidential.

This experiment consists of **six** completely independent parts.

Throughout the experiment, and based on your decisions, you can earn ECUs.

Your earnings are expressed in ECUs. Your total earnings for the experiment correspond to the total amount of ECUs accumulated.

At the end of the experiment, your ECU earnings will be converted to euros at the rate of 100 ECUs=€7.50 euros (1 ECU=€0.075).

The "donations" part of the experiment will guarantee you ECU earnings.

Of the six parts of this experiment, **four parts can also allow you to earn additional money: the "risk" part, the "colors" part, the "association" part, and the "lottery" part.** We will explain the procedure at the beginning of each part determining your earnings.

The experiment has a total of 290 decisions. Each decision has been randomly assigned a number. We will ask you to choose a number between 1 and 290 that corresponds to the decision that determines your payment. At the end of the experiment, you will know what decision it is. At the beginning of each part, we will remind you that the decisions made in this part are part of the 290 decisions that can earn you additional money.

As a thank you for your participation, you will receive 7 euros in addition to the earnings accumulated in the experiment.

The total payment of your earnings in euros will be made in cash and privately at the end of the experiment.

The following two parts will appear randomly.

Stage "Risk"

In this part of the experiment, your choices will have no impact on the following parts of the experiment and will only impact your earnings.

You will have to make 10 decisions. On the next screen, you will find 10 lines, each corresponding to a decision.

The decision for each line is to indicate the option you prefer between option A and option B. You can change from one option to another only once.

Note that in this part of the experiment, the decisions you make will not impact your earnings determined in the "donation" part of the experiment. If this part of the experiment is chosen, you can earn an additional gain based on your decisions.

This part of the experiment may determine your additional earnings based on the number you chose at the beginning of the experiment.

Stage "Colors"

In this part of the experiment, you will successively see six tables.

In each of the six tables, you have 20 decisions to make. For each decision, you must choose **the option that you prefer** between option A and option B.

Within a single table, option A remains the same throughout the 20 decisions you have to make. Regarding option B, the probability (chances) of winning ECUs increases with each row.

Once you have chosen option B, you can no longer choose option A for subsequent decisions.

If one of the tables in this section is chosen to determine your additional payment, then at the end of the experiment, we will randomly draw one marble from 30 marbles. Three colors of marbles are present in the urn: blue, violet, and orange.

You do not know the number of marbles for each color (**unknown probabilities**).

You will be paid based on your decisions and the marble's color drawn at random.

Note, in this part of the experiment, the decisions you make will not affect your gain determined in the "give" part. If this part is chosen, you can receive an additional gain based on your decisions, and the marble's color will be randomly drawn at the end of the experiment.

This part of the experiment is likely to determine your additional gain based on the number you chose at the beginning of the experiment.

Stage "Donation"

In this section, we will propose that you donate to an environmental association of your choice.

We will present you with a list of environmental associations. You must choose one from the following list. Your donations will actually be transferred to the association you have chosen.

We have specified for each association its mission, as specified on its website. The associations are presented in alphabetical order.

Greenpeace: "Greenpeace is an international network of independent organizations that act based on non-violent principles to protect the environment, biodiversity, and promote peace. It relies on a movement of engaged citizens to build a sustainable and equitable world."

WWF: "Since 1973, WWF France, a public utility foundation, has acted on a daily basis to offer future generations a living planet. We act to curb environmental degradation and build a future where humans live in harmony with nature."

Zero Waste France: "They defend an ambitious zero waste, zero waste approach, which prioritizes source reduction. Their vision is part of a global ecological transition, respect for human rights and a better consideration of the most

disadvantaged populations and future generations."

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We will now explain how you can make your donation.

We give you an amount of 100 ECUs and you must choose an amount that you want to donate to the association you have chosen, this amount must be between 0 and 100 ECUs.

You will keep the remaining ECUs for certain that you have decided not to donate to the association.

The total number of ECUs is equal to 100, that is, the sum of ECUs Kept (EG) by you and the ECUs Given (ED) must be equal to 100 (EG + ED = 100).

The ECUs that the association will receive will depend on the ECUs that you have given and the color of the marble that will be drawn at the end of the experience.

This amount will be actually paid to the association of your choice.

– –

We will now explain the random draw that will take place at the end of the experiment.

The exact amount you will give will not always reach the NGO. **Three outcomes are possible:** either the association will receive 0 ECUs, or it will receive the exact amount you have given the NGO, or it will receive double the ECUs you have given the NGO.

We will draw a marble from an unknown or known composition urn.

In order to determine which urn we will draw the ball from, we will conduct a pre-draw to determine whether we will use the known or unknown composition urn.

This first urn is composed of 10 balls: 3 orange balls and 7 white balls.

If the white ball is drawn: with **70%** chances, we have **no information** about the probabilities of the three outcomes: we will draw a marble from an unknown composition urn.

If the orange ball is drawn: with **30%** chances, we know the exact **probabilities** of each outcome: we will draw a marble from a known composition urn.

These probabilities are:

There is a **60%** chance that the association will receive **exactly the number of ECUs** that you have decided to give it (ED). This will happen if a blue marble is drawn at the end of the experiment. There are 18 blue marbles among the 30 marbles in the known composition urn.

There is a **30%** chance that the association will receive **twice the number of ECUs** that you have decided to give it (2 × ED). This will happen if an orange marble is drawn at the end of the experiment. There are 9 orange marbles among the 30 marbles in the known composition urn.

There is a **10%** chance that the association will receive **nothing** (0 × ED), regardless of the ECUs you have decided to give it. This will happen if a purple marble is drawn at the end of the experiment. There are three purple marbles among the 30 in the known composition urn.

At the end of the experiment, **one of the three outcomes will occur**.

The realization of one of the outcomes will depend on the color of the marble, which will determine the amount of donation the NGO will receive.

This part of the experiment will determine your gain independently of the number chosen at the beginning of the experiment. This part will not determine your additional gain.

Stage "lottery"

This part of the experiment is completely independent of the choices made in the donation part.

In this part of the experiment, two tables will appear successively.

In each table, you will have to make 20 decisions (each table has 20 lines).

Each decision involves choosing your preferred option between options A and B.

Option A **does not change** depending on the decisions (lines), whereas choosing option B means the amount you (or the organization) can win **changes**.

If you choose option A, a lottery will be drawn, and based on the result, the organization will receive additional ECUs (either 0, 30, or 60 ECUs).

If you choose option B, the organization (you) will win additional ECUs for sure.

The decisions you make can impact your payment and the amount received by the NGO.

Note: In this part of the experiment, the decisions you make will not impact the amount (ECUs given) that the organization will receive, which was determined in the donation part of the experiment, nor your kept ECUs (you will receive your kept ECUs from the "donation" part of the experiment for sure).

If this part of the experiment is chosen, you or the organization can earn additional money based on your decisions and the color of the marble drawn at the end of the experiment.

This part of the experiment may determine your additional earnings based on the number you chose at the beginning of the experiment.

Reminder:

If the known composition urn is drawn (30% chance), then we will present you with an urn with 30 marbles and three colors: Blue (18 marbles), violet (3 marble), and orange (9 marbles).

If the unknown composition urn is drawn (70% chance), then we do not know the number of marbles for each color (unknown probabilities).

You and the organization will be paid based on your decisions and the color of the marble drawn at the end of the experiment.

Stage "NGO"

In this part of the experiment, you will see six tables in succession.

In each of the six tables, you have 20 decisions to make. You must choose the **option that you prefer** between option A and option B.

Be careful, once you have chosen option B, you cannot choose option A anymore.

Within the same table, option A remains the same throughout the 20 decisions you have to make. As for option B, the probability (the chances) of winning ECUs increases with each line.

If one of the tables in this part is chosen, then the marble's color drawn at the end of the experiment will determine your additional gain.

Reminder: If the known composition urn is drawn (30% chance), then we will present you with an urn with 30 marbles and three colors: Blue (18 marbles), violet (3 marbles), and orange (9 marbles).

If the unknown composition urn is drawn (70% chance), then we do not know the number of marbles for each color (unknown probabilities).

Note: In this part of the experiment, the decisions you will make will not affect the amount (ECUs given) that the association will receive, nor your ECUs kept (you receive your ECUs kept from the *donation* part of the experiment). If this part of the experiment is chosen, you can obtain an additional gain based on your decisions and the color of the marble drawn at the end of the experiment.

This part of the experiment is likely to determine your additional gain, based on the number you chose at the beginning of the experiment.

The amount that the association will receive only depends on the choice you made in the previous part and the color of the marble drawn at the end of the experiment.