Decisions from experience: Time delays, complexity and illusions of control

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To Juana and Miriam

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Abstract

This thesis includes three chapters that study different aspects of the distinction between decisions from description and decisions from experience. Chapter 1 studies choice when decision makers have both information from description and information from experience. Results suggest that experience is disregarded in the face of description. Individual differences with respect to rational ability are also explored. Participants with higher rational ability draw larger samples than participants with lower rational ability. Chapter 2 examines situations in which information from experience is a better source than information from description. Complex scenarios and delayed judgmental tasks favor experience over description as a source of information. Moreover, there were no individual differences due to numerical/rational abilities. Additional evidence was found that relates higher rational ability to larger samples. Finally, chapter 3 explores how illusion of control interacts with the source of information in a lottery task.

Resumen

Esta tesis incluye tres capítulos que exploran diferentes aspectos de la distinción entre decisiones desde la descripción y decisiones desde la experiencia. El capítulo 1 estudia escenarios de decisión cuando las personas cuentan con información tanto desde la descripción como desde la experiencia. Los resultados sugieren que la experiencia es desatendida ante una descripción. También se explora el impacto sobre las decisiones de la habilidad racional. Las personas con habilidad racional más alta obtienen muestras de mayor tamaño que las personas con menor habilidad racional. El capítulo 2 examina situaciones en las que la información obtenida desde la experiencia resulta una mejor fuente de información que una descripción. La complejidad y las demoras favorecen a la experiencia sobre la descripción como fuente de información. No se evidencian diferencias individuales con respecto a habilidades numéricas o racionales. Sin embargo, se evidencia una relación entre mayor habilidad racional y mayor tamaño muestral. Por último, el capítulo 3 explora, para una tarea de lotería, la interacción entre la ilusión de control y la fuente de información.

Introduction

Our lives are shaped by a vast collection of decisions, from the trivial like choosing our servings for breakfast to the life-changing like deciding to give birth. We choose how we spend our time and the words that express our thoughts and feelings. Moreover, we choose our thoughts and we question our feelings. Even when we attempt to avoid conflictive choice situations, when we prefer to remain aside, we are in fact deciding not to decide. It seems that we cannot escape our responsibility to make decisions. Because decisions are the essence of behavior, because they reveal our needs and desires, the study of how people make decisions is of fundamental relevance for the behavioral sciences.

Decisions are of multiple types, so the scientific approach to decision making classifies these according to their characteristics. One classification focuses on the risk associated with the options to be evaluated. This view entails three types of decisions: decisions with certainty; decisions under risk, and decisions under uncertainty. In decisions with certainty, decision-makers choose among non-risky, certain options. Choosing a product at a store is an example of this choice situation. Options in this decision scenario can entail various additional characteristics, like single or multiple attributes, be delivered instantly or in the future, be monetary or non-monetary, among other features.

Decisions under risk are those where options are not certain but involve some degree of risk known to the decision-maker. In these cases, outcomes and likelihoods are explicit. The choices between lotteries like those used in Prospect Theory (Kahneman and Tversky, 1979) are the typical case of decisions under risk. Gambling on the outcome of a die toss is another example.

Decision scenarios where options are risky but their likelihoods of occurrence are unknown to the decision-maker are known as decisions “under uncertainty” or “under ambiguity”. While in a coin toss the likelihood of each outcome is known, the probability of correctly choosing the right dish at a restaurant is highly uncertain. Another example of this type of decision is whether to purchase insurance for risky activities when we do not exactly know the chances associated with the outcomes, like those associated with health, accidents, and climate catastrophes.

A recent distinction between decisions is one that relies on the way information about options is obtained. This view distinguishes decisions made from description and decisions made from experience. While in decisions from description, all possible outcomes and their probabilities of occurrence are known by the decision-maker, in decisions from experience decision-makers learn about outcomes and probabilities by sampling the options. Sampling is essential in most decisions. We try the suit a few times before purchasing it. We attend to class a few times before deciding to register for the course. We may poll our friends to decide on a book, a restaurant or a movie.

Decisions can overlap with respect to their classification. While it is clear that decisions from description are "under risk", it is less clear whether decisions from experience should be considered "under risk" or "under uncertainty". The classification will depend on the degree of confidence that samples from experience allow the decision maker to draw inferences. While large samples allow for confident inferences about the likelihood of outcomes, small samples may not allow confident inferences and also misrepresent the probability that generates the outcomes. Thus, the size of the sample will determine the amount of uncertainty involved in the decision situation. Large samples move decisions from experience closer to the classification of "decisions under risk"; small samples draw them closer to "decisions under uncertainty".

The research reported here is focused on the distinction between the choice patterns that emerge from decision scenarios where information about outcomes and probabilities is obtained from description and scenarios where this information is obtained from experience. Moreover, although this distinction is central to the work, more attention is paid to decisions from experience given their novelty within the field.

The method used to study decisions is laboratory experimentation. This approach consists of modeling choice situations in a laboratory setting, typically in the form of computer software or other material like decks of cards of bags of tokens. Options are presented to the subjects and they choose their best preferred alternative driven by a monetary compensation scheme designed according to the hypothesis of the experiment. Experimentation in decision science has borrowed from experimental psychology, and it has helped produce relevant knowledge in the field of economics, mostly as a descriptive tool for hypothesis testing. In line with the descriptive relevance of experimentation, the nature of this thesis is also descriptive. It studies how people make decisions in different contexts. Nonetheless, within its descriptive approach, this work has a natural prescriptive drive. While revealing the choice and sampling patterns observed in experimental subjects, lessons can be derived to improve decision making outside the laboratory. Some of the lessons that will be learned from this research relate to probability weighting, information search, sampling biases, and illusions of control.

This thesis includes three chapters that are closely related and yet self-contained. Chapter 1 explores choice situations in which decision makers choose one of two options based on precise descriptions and also on the experience obtained from sampling the options. Chapter 1 explores the question of how relevant experience is when precise descriptions of the options are available. Results suggest that people choose according to what they observe: small samples are treated as reliable for drawing inferences; and experience is disregarded when a description of the alternatives is available.

Because we tend to value experience in many domains, results in Chapter 1 are counter-intuitive. We pay higher wages to experienced professionals, we trust our savings to experienced banks, and we even trust our health to experienced physicians. Therefore, the results obtained in the first chapter, and in other studies within this paradigm, made me question the reality of the experimental design. So, in Chapter 2 I explore two realistic aspects of decision making that portray experience as a favorable source of information when compared to description. When the choice situation involves a time delay between information acquisition and a judgmental task, as well as when choice scenarios are complex, information from experience may be preferred to information from description because it leads to better judgments of frequency and because it provides an alternative to costly cognitive effort, thereby simplifying the choice process.

Early studies suggested that the different choice patterns observed in decisions from description and decisions from experience could be explained by sampling and recency biases. More recent studies, however, suggest that these two effects do not account for the choice gap entirely. Chapter 3 explores another cognitive bias that takes place in the process of sampling. In collaboration with my brother, José Lejarraga, we explore how illusions of control mediate decisions from experience and decisions from description. Results show that illusion of control interacts with the source of information in an interesting manner. While subjects that sample a lottery from experience bet higher amounts when the lottery is activated by themselves (rather than the experimenter), subjects that learn about the lottery from description bet higher amounts when the lottery is activated by the experimenter.

The meanings of the expressions “choice” and “decision” are not necessarily equivalent, as the first can be interpreted as the result of the second. Yet, their meanings sometimes overlap as they are commonly used to refer both to the process and result of a selection among alternatives. Throughout this work, both expressions, as well as their verbal forms, are used indistinctively.

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1. DECICIONS FROM EXPERIENCE: JUST PART OF THE PICTURE

1.1 Introduction

A recent article by Hertwig, Barron, Weber and Erev (2004) revealed that decisions from experience and decisions from description can lead to dramatically different results. The authors show that limited information search implies that rare events tend to be under-represented in the sample compared to their objective probabilities and therefore are underweighted in choice. Do description and experience, as tested in Hertwig et al. (2004), provide the same information? This study presents a simple viewpoint. It argues that information obtained from experience provides a partial view of the choice problem. Moreover, people's choices reflect what they have seen. They consider samples drawn from experience as providing unbiased estimators of the probabilities affecting choice. Possible effects of individual personality differences on risky choice are also investigated.

1.2 Decisions from experience and description

Hertwig et al. (2004) contrasted risky choices based on information from description, on the one hand, and information from experience, on the other. In the former, people were provided with probability distributions over potential outcomes as in the experimental paradigm used by Kahneman and Tversky (1979) and others. In the latter, probabilities and outcomes were not provided but had to be learned by sampling from these distributions. This study revealed that in decisions from description participants tend to overweight rare events as claimed by prospect theory but that in decisions from experience participants tend to choose as if they underweight rare events, thus contradicting prospect theory.

In reaction to Hertwig et al.'s (2004) study, Fox and Hadar (2006) claimed that decisions from description and decisions from experience, as tested by Hertwig et al. (2004), cannot be compared since the first involved "objective" gambles and the second "observed" and "judged" gambles that were typically different from the first. Using

Hertwig et al.’s (2004) own data, Fox and Hadar observed that when choices were based on “observed” as opposed to “objective” probabilities, participants actually weighted rare events in accordance with prospect theory.

1.3 Information from experience and description

People apprehend the world either by experience (their own or that of others) or by description. By sampling, as in Hertwig et al.’s (2004) set up, participants attempt to learn about a decision situation. Driven by curiosity, they experience gambles as many times as they wish, gaining additional information with each new observation. Because sampling infinite times would guarantee identical “observed” and “objective” probabilities, it should be clear that information from experience is a partial representation of information from description.

A problem with estimating the probability of a rare event through repeated sampling is the fact that the binomial sampling distribution is skewed (unless the event occurs with a probability of 0.5) and its skewness becomes more pronounced when samples get smaller. In Hertwig et al. (2004), the participants’ limited search effort reduced the probability of observing the rare event as frequently as expected by its objective probability. That is, by failing to sample sufficiently, participants did not gain enough information to estimate the “objective” probability of the rare event. In particular, participants revealed a lack of awareness of the skewness of the binomial sampling distribution, and chose as if the observed sample characteristics accurately represented the population from which the sample was drawn. In consequence, rare events were underweighted in choice.

If description provides full information about a gamble and drawing small samples provides partial information, I predict that the impact of rare events on choices will be smaller for participants that sample them at a rate less than the objective expectation (undersampling) and larger for participants that sample them at a rate greater than the objective expectation (oversampling).

1.4 Experiment 1

Forty-four students at Universitat Pompeu Fabra (Barcelona, Spain) were presented with three decision problems displayed in Table 1. These problems were taken from Barron and Erev's (2003) feedback design and payoffs were doubled. The three problems differ with respect to expected value, two are positive prospects and one is negative. Nineteen participants, the description group, saw the problems described as in Table 1 on a computer screen. Twenty-five participants, the experience group, saw two buttons on the computer screen and were told that each button was associated with a payoff distribution. Clicking on a button elicited the sampling of an outcome (with replacement) from its distribution. Participants could sample in whatever order they desired and for as long as they desired. They were encouraged to sample until they felt confident enough to play for a monetary payoff. Once they had stopped sampling they had to indicate their desired option and turned to the next problem. Participants were paid 3€ for showing up and 1 cent for each point won (e.g., outcome 64 in Problem 3 paid 64 cents).

Table 1

Decision problems and their expected values

	Options		**Expected Value**		
Decision problem	**H**	**L**	**H**	**L**	**Rare event**
1	8, 0.8	6, 1	6.4	6	0, 0.2
2	-6, 1	-64, 0.1	-6	-6.4	-64, 0.1
3	64, 0.025	6, 0.25	1.6	1.5	64, 0.025

Note. H: option with the higher expected value. L: option with the lower expected value. Only one outcome is given for each option, followed by its probability of occurrence. The second outcome is not stated. It was 0 and had a probability complementary to the stated one. For example, the outcomes of the H option in Problem 1 were 8 with a probability of .2 and 0 with a probability of .8.

The following analysis replicates Hertwig et al.'s (2004) methodology. It is a comparison of the percentage of H-choices in the experience group relative to the description group. The following are the predictions for the cases when the rare event is observed less frequently than expected:

- Problem 1: The percentage of H-choices should be higher in the experience group than in the description group, because the under-representation of the rare event (gaining 0 with probability 0.2) makes lottery H more attractive.

- Problem 2: The percentage of H-choices should be lower in the experience group than in the description group, because the under-representation of the rare event (losing 64 with probability 0.1) makes lottery L more attractive.

- Problem 3: The percentage of H-choices should be lower in the experience group than in the description, because the under-representation of the rare event (gaining 64 with probability 0.025) makes lottery L more attractive.

- When the rare event is observed more frequently than expected, choices between the experience and the description group should not differ.

Results

On average, 16 respondents sampled the rare event less frequently than expected (sample size times the objective probability of occurrence of the rare event). In these cases, decisions from experience differed from decisions from description. For the two positive gambles, the results confirmed the predictions. As shown in Table 2 (a), the percentage of participants that chose option H differed markedly between the two groups. In problem 1, 79% of participants in the experience group selected option H, whereas only 53% in the description group selected this option. These results resemble Hertwig et al.'s (2004), who found 88% and 36%, respectively for a similar gamble with half the payoffs. In problem 3, only 10% of the experience group selected option H against 37% in the description group. The differences in the proportions of H-responses were statistically significant for problems 1 and 3. The difference in problem 2, the negative gamble, was not significant.

Table 2

Percentage of respondents choosing H

Decision problem		% choosing H			
H	**L**	**Desc. group**	**Exp. group**	**Prediction for H choices**	**Difference between groups**
(a) Respondents that sampled the rare event less frequently than expected					
8, 0.8	6, 1	53%	79%	Exp.higher	-26% (z = 1.70, p = .04)
-6, 1	-64, 0.1	0%	5%	Exp.lower	-5% (z = -1.01, p = .84)
64, 0.025	6, 0.25	37%	10%	Exp.lower	27% (z = 1.54, p = .06)
(b) Respondents that sampled the rare event as or more frequently than expected					
8, 0.8	6, 1	53%	50%	Desc. = exp	3% (z = 0.11, p = .54)
-6, 1	-64, 0.1	0%	33%	Desc. = exp	-33% (z = -2.62, p< .01)
64, 0.025	6, 0.25	37%	53%	Desc. = exp	-16% (z = 0.96, p = .83)

Note: The difference between groups is a one-tailed z-test for different proportions

Across the three problems, an average of 9 participants sampled the rare event more frequently than expected.[1] These participants showed no between-group differences (see Table 2, b). For instance, the percentages of H-responses in problem 1 were: 50% in the experience group and 53% in the description group. In problem 3, the proportion of H-responses was 53% and 37% for the experience and the description group, respectively. The differences in the proportions of H-responses were not statistically significant for problems 1 and 3. Contrary to Hertwig et al.'s (2004) findings, problem 2 does not match the prediction and shows a significant between-group difference.

A logit regression model was defined to test how choices are a function of the ratio of observed rare events over the total number of experiences. The model has the form $Y_i = \alpha + \beta X_i + \mu_i$ where dependent variable Y takes values 1 for H choices and 0 for L choices, X is the frequency of observed rare events, and μ_i is an error term. Results reveal that the ratio of observed rare events over the total number of experiences is positively related to the choices drawn by participants for positive gambles. In

[1]Three participants observed the rare event as frequently as expected in one of the three decision problems. For clarity, I will refer to the group of participants that sampled the rare event as frequently as expected and more frequently than expected as simply "more frequently than expected".

problem 1, there is a positive relation between the ratio and L-choices ($p = 0.040$) and in problem 3, there is a positive relation between the ratio and H-choices ($p = 0.026$). This pattern is also observed in problem 2 but the effect is not significant ($p = 0.134$). The model predicts correctly 72% of choices for problem 1 and 80% for 3. For problem 2, the model is not reliable as it has a false negative rate for H-choices of 100%.

In summary, for positive gambles, the observed frequency of rare events determines, to a significant extent, the choices in the experience group. We found that rare events had less impact than they deserved objectively when participants undersampled them, as in Hertwig et al. (2004). However, participants who sampled the rare event more frequently than expected did not weight the rare events significantly differently from participants who learned about the gambles by description. Although the observed effect and argument should also extend to negative gambles (problem 2), the effect is not present.

If description provides full information about a gamble and undersampling provides partial information, once full descriptive information is obtained about a risky situation, additional information from experience should not have an effect on choices. Additionally, the order in which information from description and experience is obtained should not influence choices.

1.5 Experiment 2

In most real life situations, decision makers have both information from description and a sample drawn from experience. Following Hertwig et al.'s (2004) example, the physician is aware of vaccination's failure rate from his scientific readings, but also counts on his professional experience. Experiment 2 expands on the previous experiment and examines a group of participants who obtained information both from experience and description. Forty-six students at Universitat Pompeu Fabra were presented with the same decision problems as in Experiment 1. To control for order effects, the order in which information from experience and description was provided was alternated. Twenty-two participants, the DE group, saw a description of the gamble as presented in Table 1 and were encouraged to sample it as much as they wanted. After sampling the gamble, respondents played for a monetary payoff and moved on to the following problem. Accordingly, 24 participants, the ED group, sampled the gambles as much as desired and before they played for a monetary payoff, the underlying objective probability was revealed to them. Participants were paid 3€ for showing up and 1 cent for each point won (e.g., outcome 64 in Problem 3 paid 64 cents).

If experience provides partial information when compared to description, the prediction is that the percentage of H-choices drawn by the description group from Experiment 1 should not differ significantly from the percentage of H-choices drawn by the experience groups (ED and DE) in Experiment 2.

Results

Experience does not add information to description in positive gambles. Table 3 shows that the percentage of H-choices is almost identical for the description group and the pooled DE + ED group. The differences for problem 1 and 3 are of 1 and 0 percentage points. This difference is present for participants that undersampled as well as for those who oversampled the rare event. None of the differences observed in problem 1 and 3 are statistically significant. In Problem 2, with options that involved a possible loss, participants weighted the rare event more heavily in the experience groups than in the description group, thereby contradicting the prediction. This difference is statistically significant.

The order in which information from description and experience was provided did not have a statistically significant effect on the impact of rare events on choice (Table 4).

Table 3

Summary of results for the Description group and the ED and DE groups

Decision problem		**% choosing H**				
H	**L**	**Desc. group**	**DE + ED under-sampling**	**DE + ED over-sampling**	**DE + ED group**	**Difference between Description and DE + ED group**
8, 0.8	6, 1	53%	50%	56%	54%	-1% (z = -0.13, p = .45)
-6, 1	-64, 0.1	0%	19%	21%	20%	-20% (z = -2.07, p = .02)
64, 0.025	6, 0.25	37%	35%	39%	37%	0% (z = 0.00, p = .50)

Note: The Description group is obtained from Experiment 1. The difference between groups is a one-tailed z-test for different proportions

Table 4

Summary of results for order effects

Decision problem		**% choosing H**		
H	**L**	**Description group**	**DE group**	**ED group**
8, 0.8	6, 1	53%	59%	50%
-6, 1	-64, 0.1	0%	14%	25%
64, 0.025	6, 0.25	37%	41%	33%

A logit regression analysis confirms that experience has no effect on choices when explicit probability information is available. The pooled DE and ED groups showed no relation between the ratio of observed rare events to sample size and choices in all three problems. When groups were analyzed separately, none of the treatments showed a significant relation, except for the ED group in problem 2, which showed a significant positive relation between the ratio of observed rare events and H-choices (p = 0.035).

To summarize, in positive gambles, additional information from experience did not lead to different weighting of rare events relative to decisions from description. The results confirm the assertion that information from experience is a subset of information from description. This effect was not observed for negative gambles. Except for problem 2, no significant order effects were observed.

1.6 Individual personality differences in risky choice

Dual-process theories suggest that people make judgments and choices based on two different systems: the intuitive and the analytic (Epstein, 1994). These systems operate in a fundamentally different manner, the first being fast, tacit, and effortless; and the second slow, deliberate, and based on systematic rules. Both systems interact in the human brain. The intuitive system is thought to activate first, providing an effortless, unconscious reaction to a situation. The analytic system is activated deliberately, typically after an intuitive reaction. It requires mental effort, which makes it slow and scarce.

Both systems are independent, and there is evidence that individual personality differences define the preference of one mode over the other when people habitually make decisions (see Cacioppo & Petty, 1982; Cacioppo, Petty, Feinstein, & Jarvis, 1996; Stanovich & West, 1998; Epstein, 1994; Pacini & Epstein, 1999).

Hogarth (2005) argues that intuitive judgment tends to rely on information that is partial, failing to consider all information about the task. Thus, the validity of intuitive judgment depends on the accuracy or representativeness of the partial information available and accessed. Contrary to intuitive judgment, analytic thought typically involves seeking and considering additional information that is not present in the decision situation.

Given the nature of intuitive and analytic judgment, and provided that rare events are under-represented in small samples, analytic participants should be able to evaluate the frequency of the rare event more precisely and reveal a more accurate risk perception than intuitive respondents.

Experiments 1 and 2 included a set of questions that measured participants' individual differences. At the end of each experiment, participants completed a numeracy test (taken and adapted from Lipkus, Samsa & Rimer, 2001) that measured the ability to understand probability numbers, and Pacini and Epstein's (1999) rational ability questionnaire taken from the rational experiential inventory. The rational ability scale measured the participants' self-reported ability of rational thinking. The numeracy test and the rational ability questionnaire are included in the Appendix.

Results from individual personality differences

The median numeracy score was 9 out of 11 possible correct answers. Following Peters, Västfjäll, Slovic, Mertz, Mazzocco, and Dickert's (2006) criterion for separation, participants with scores from 9 to 11 in the numeracy test were considered high numerates and participants with scores from 0 to 8 were considered low numerates. Participants were also split into high rational ability and low rational ability by the sample median (23.5), as suggested by Pacini and Epstein (1999).

Across the three problems, high rational ability participants sampled the gambles more frequently than low rational ability participants (Table 5). This pattern is not observed when participants are classified by their numeracy. Participants in the experience group sampled the gambles a median of 21 times, 40% more than Hertwig et al.'s (2004) 15 draws. Across problems, the number of draws from option H was similar to the number of draws for option L. Table 5 describes the average experiences and provides two-tailed t-tests for different means. Sampling results for the DE and ED groups are omitted because sampling may have been influenced by the availability of descriptive information.

No significant influence of individual differences was observed on weighting of rare events.

Table 5

Mean sampling in the experience group by rational ability

Rational Ability		
Problem 1 (8, 0.8 & 6,1)	**Samples**	
High Rational ability	36.8	t = 1.6, p = 0.06
Low Rational ability	14.7	
Problem 2 (-6,1 & -64, 0.1)	**Samples**	
High Rational ability	35.8	t = 1.8, p = 0.03
Low Rational ability	16.2	
Problem 3 (64, 0.025 & 6, 0.25)	**Samples**	
High Rational ability	43.4	t = 2.0, p = 0.02
Low Rational ability	20.0	

1.7 Conclusions

The present study adds evidence to the article by Hertwig et al. (2004) which states that rare events tend to have a larger impact on choices when based on information from description (as postulated by prospect theory) and a lesser impact when based on information from experience. The results from this study suggest that, for positive gambles, information obtained from experience is partial, and can only be obtained fully if the rare event is sampled as much as expected by its underlying objective probability. It also adds to the notion that people do not understand the implications of the random nature of the sampling process such as skewed sampling distributions and the effects of sample size.

The hypothesis was tested with two experiments. The first revealed that, for positive gambles, when rare events were undersampled, rare events had a lower impact relative to their objective probability, as in Hertwig et al. (2004). However, when rare events were oversampled, participants chose in the same manner as the description group (and according to prospect theory). The second experiment revealed that, for positive gambles, adding information from experience to information from description did not lead to different weighting of rare events, regardless of the order in which the information was obtained, and whether the rare event was under or oversampled.

No conclusion can be drawn for negative gambles as tested in this study. Results for just one problem framed as losses suggest that negative experience may influence the estimation of risks in the face of descriptive information. In evaluating negative prospects (e.g. being killed by a terrorist attack and monetary losses), Yechiam, Barron and Erev (2005) found similar results. The authors found field and experimental evidence indicating that the exposure to negative rare events reduces the overestimation of risks when description-based information was available.

The choice pattern from description in problem 2 is strikingly different to the pattern observed in a similar problem in Hertwig et al. (2004). While in Experiment 2 none of the participants preferred the sure loss, in Hertwig et al (2004) the proportion of choices from description for the sure loss was 64%. From experience, however, results in Experiment 2 are as expected, and highly similar to Hertwig et al.'s (2004). It remains unclear why all participants in the description group avoided the sure loss of 6 cents and preferred the risk of losing 64 cents with a probability of 0.1. This choice behavior suggests the influence of the certainty effect (Kahneman & Tversky, 1979) which asserts that decision-makers prefer uncertain losses to certain losses with a lower expected value.

It is striking that for the ED group, in which a description was provided after experience (and before choosing), 25% of the participants chose the certain H option. This suggests that risk-avoiding behavior may be affected by experience. The influence of experience in the presence of descriptive information is also reported by Ward and Jenkins (1965). Though in a different context, the authors show experimentally that experience negates the effect of description in participants assessing the correlation of cloud seeding and rain.

The approach to individual differences provided no significant evidence with respect to the weighting of rare events. Yet, the study suggests that in decisions from experience, high rational ability participants tend to search more actively for information than low rational ability participants. It is important to note that not much attention has been paid to the relation between individual differences and information search. Cacioppo and Petty (1982) stated that individuals high in "need for cognition" (a scale that measures an individual's tendency to engage in and enjoy thinking and developed by Cohen, Stotland, & Wolfe, 1955) are likely to expend more effort on information acquisition than individuals low in need for cognition.

If a relation could be established between the classifications by Cacioppo and Petty and the ones presented in this study, "high need for cognition" would most relate to high numerates and high rational ability. Accordingly, "low need for cognition" would approximate to low numerates and low rational ability. If this association is valid, the results presented in this study agree with previous findings.

1.8 Not experienced and fatal events

There exist several rare events that may affect our lives and cannot be experienced. They occur in a different geographical location, are displaced in time, or simply because their effects are not perceptible. Examples abound. The effects of burning fossil fuels may increase global warming, but the effects do not manifest themselves in the location where the gases were emitted. Instead, they may accumulate and be revealed in the form of a climate catastrophe somewhere in the globe a number of years later. Another example is the risk involved with smoking. Young smokers do not experience the negative effects of their habit because consequences only become visible late in adulthood (Slovic, Fischhoff, and Lichtenstein, 1981). These are examples of rare events that are not experienced. There is also the case of events that can only be sampled once. These are fatal, rare events which, by definition, exclude decisions after their occurrence.

Results from this study suggest that rare events that cannot be sampled or that are fatal will always be underestimated. In this context, information from description plays a key role in helping to construct a better perception of this type of risk.

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1.10 Appendix

Numeracy Test (Spanish)

1. Imagine que tiramos un dado de seis lados unas 1.000 veces. ¿Cuántas veces cree usted que dará un valor par (2, 4 ó 6)? Respuesta: 500 de 1.000
2. En la lotería de LAS PELAS, la probabilidad de ganar 10.000 € es 1%. ¿Cuánta gente cree usted que ganará un premio de 10.000 € si 1.000 personas compran un ticket cada una? Respuesta: 10 de 1.000
3. En la lotería de la tienda ACME, las probabilidades de ganar un coche es de 1 en 1.000. ¿Que porcentaje de tickets de ACME ganan un coche? Respuesta: 0,1%
4. ¿Cuál de los siguientes números representan el mayor riesgo de contagio de una enfermedad? ___ 1 en 100, ___ 1 en 1.000, _X_1 en 10
5. ¿Cuál de los siguientes números representan el mayor riesgo de contagio de una enfermedad? ___ 1%, _X_ 10%, ___ 5%
6. Si el riesgo de la persona A de contagiarse una enfermedad es de 1% en diez años, y el riesgo de la persona B es el doble que el de A, ¿cuál es el riesgo de B? Respuesta: 2%
7. Si la probabilidad de la persona A de contagiarse una enfermedad es de 1 en 100 en diez años, y el riesgo de la persona B es el doble que el de A, ¿cuál es el riesgo de B? Respuesta: 2 de 100

8. Si la probabilidad de contagiarse una enfermedad es de 10%, ¿cuánta gente cree que se contagiará…

   A: de entre 100 personas? Respuesta: 10

9. B: de entre 1.000 personas? Respuesta: 100
10. Si la probabilidad de contagiarse una enfermedad es 20 de 100, esto sería lo mismo que tener una probabilidad del ___% de contagiarse. Respuesta: 20
11. La probabilidad de contraer una infección viral es 0.0005. De 10.000 personas, ¿cuántas cree que se infectarán? Respuesta: 5

Rational Ability Scale

Participants completed a five-interval response scale (where 1 indicated that the statement was false and 5 indicated that the statement was true) for each of the statements listed in Table 6. “Ra” Denotes Rational Ability. A minus sign (-) denotes reverse scoring.

Table 6.

Rational Ability Scale

English		**Spanish**
I’m not that good at figuring out complicated problems.	Ra-	No soy tan bueno para resolver problemas complicados.
I am not very good at resolving problems that require careful logical analysis.	Ra-	No soy muy bueno resolviendo problemas que requieren un análisis lógico cuidadoso.
I am not a very analytical thinker.	Ra-	No soy un pensador muy analítico.
Reasoning things out carefully is not one of my strong points.	Ra-	Razonar las cosas cuidadosamente no es uno de mis puntos fuertes.
I don’t reason well under pressure	Ra-	No razono bien bajo presión.
I am much better at figuring things out logically than most people	Ra	Soy bastante mejor que la mayoría de la gente cuando se trata de comprender algo lógicamente.
I have a logical mind	Ra	Tengo una mente lógica.

I have no problem thinking things through carefully	Ra	No tengo problema en pensar las cosas cuidadosamente.
Using logic usually works well for me in figuring out problems in my life	Ra	Normalmente, se me da bien usar la lógica para resolver los problemas de mi vida.
I usually have clear, explainable reasons for my decisions	Ra	Normalmente tengo razones claras y explicables para mis decisiones.

2. WHEN EXPERIENCE IS BETTER THAN DESCRIPTION: TIME DELAYS AND COMPLEXITY

3. WHAT'S IN SAMPLING? HOW ILLUSION OF CONTROL MEDIATES AN EXPERIENCE-BASED TASK

3.1 Introduction

Recent experimental research on risky choice suggests that depending on the information source to which decision makers are exposed, personal experience or description, decisions can lead to differences in choice behavior and risk taking (Hertwig, Barron, Weber, and Erev, 2004). Notably, subjects making decisions from experience choose as if small probability events are underweighted, whereas subjects from description choose as if these are overweighted, following prospect theory (Kahneman & Tversky, 1979).

To explain this description-experience gap, research has focused on how subjects perceive or weight the observed probabilities of the repeated random events that are being evaluated. Early findings suggested biases derived from the under-representation of small probability events in small samples of binomial processes, and recency effects. Yet, these biases do not seem to account for the choice gap entirely (Hau, Pleskac, Kiefer & Hertwig, 2008). One signal that this probabilistic approach may be misleading is the fact that subjects who sample lotteries at no cost draw strikingly small samples, as if they were unaware of the law of large numbers. What effect, in addition to the weighting of probabilities, can shed light onto the description-experience gap? One cognitive mechanism that has been shown to be activated in processes of repeated random events, and that influences risk taking, is the "illusion of control" (Langer and Roth, 1975): a pervasive misperception that one's chances of success at a purely random task are greater than would be warranted by its objective probability (Koehler, Gibbs, and Hogarth, 1994). Early research showed that people commonly confuse luck for skill (Langer, 1975) believing that they can exert certain degree of control over clearly uncontrollable events such as random card games or rolling dice. This cognitive bias is emphasized when the context contains skill-related elements that favor performance in a skill task, but would have no influence on a chance task. For example, illusion of control is observed when people have the chance to practice the task, which increases the degree of involvement with the task (Matute, 1996; Thompson, Thomas & Armstrong, 1998) and when subjects have more time to think about the task (Langer, 1975), among several other situations. Because the conditions that facilitate the illusion of control vary depending on the context and particularly on the contexts of information acquisition, we propose that illusion of control interacts with the source of information influencing risk-taking behavior, as revealed in the description-experience gap.

Although much research on judgment and decision-making under uncertainty has focused on cognitive biases that influence human behavior (Kahneman, Slovic & Tversky, 1982; Hogarth, 1987), little research has approached the interactions between these biases (Budescu & Bruderman, 1995). This study focuses on the relationship between experience-based learning and the illusion of control, two phenomena that often cause people to have a naïve perception of the world they live in.

Insight on the interaction of experience-based choice and illusion of control has clear implications for practical decision making because both phenomena tend to reduce risk perception and increase risk taking (Simon, Houghton & Aquino, 2000). On the one hand, experience often makes people avoid taking precautions (Weber, 2006); stop using safety devices (Yechiam, Erev & Barron, 2006); undermine warnings (Barron, Leider & Stack, 2008); and expose ourselves to rare but deadly terrorist attacks (Yechiam, Barron & Erev, 2005). On the other hand, illusion of control leads managers to commit more resources to risky strategic decisions (March and Shapira, 1989), increases the likelihood of placing risky bets in areas where greater degree of control is perceived (Heath and Tversky, 1991) as well as promoting organizations' positive forecast bias (Durand, 2003). In contexts that facilitate the illusion of control, decision makers may have access to information from past experiences or from descriptive statistics, which may influence risk taking beyond the illusion of control.

3.2 Small samples from experience and the need for alternative explanations

Recent findings suggest that the description-experience gap persists even when samples are large, when stakes are high, and when there are no recency effects (Hau et al, 2008; Rakow, Demes & Newell, 2008; Barron, Leider & Stack, 2008). Yet, one pattern found across all studies of experience-based choice is the tendency of subjects to draw small samples, even when sampling is practically costless. The robustness of this finding supports Fiedler's (2000) view that people tend to be naïve with respect to their sampling behavior and reveals a general ignorance of the law of large numbers. This tendency is also fueled by people's illusion of validity (Einhorn and Hogarth, 1978), a false belief that small samples are unbiased and representative of underlying probabilistic phenomena. The strikingly small samples that subjects tend to draw from experience suggest that information obtained from sampling about risky events may not be directly mapped into probabilities or frequencies of occurrence as inputs for decision making. Experience-based choice may, therefore, be influenced by other phenomena, likely related to the nature of the sampling process, rather than to the probabilistic nature of repeated events. Some evidence for this argument was provided by Hau et al. (2008), who found that choices from experience were best predicted by the outcome of the highest paying lottery, rather than by a collection of models that accounted for observed frequencies of outcomes.

Associative-learning models, as the value-updating model and the fractional-adjustment model, also assume this view. In these models, choices are based on the relative attractiveness of one lottery over the other, which is updated sequentially after each experience. Though these models attempt to capture the cognitive mechanism driving experiential learning, they have failed to predict choice from experience accurately (Weber, Shafir & Blais, 2004; Lejarraga, 2009; Hau et al, 2008).

Then, what cognitive mechanism can be activated in the process of sampling that may influence risk-taking behavior? A substantial body of literature shows that the illusion of control influences risk-taking behavior in a variety of experimental and naturalistic settings that contain elements that are also present in situations in which people learn from experience. This cognitive bias has been shown to be present in situations where involvement and familiarity with a task are high; when the subject has time to think about the task (Langer, 1975; Matute, 1996; Thompson et al., 1998); and when the information is obtained in the form of a sequence (Ward and Jenkins, 1965). Precisely, the degree of involvement and familiarity is one key difference between a context where information is obtained from experience and a context where information is obtained from description. When sampling from a probability distribution, each draw involves a complex collection of feelings that fuel involvement: intrigue before the first draw; surprise followed by joy or disappointment after observing the outcome; confidence after several correctly predicted outcomes, irritation after a negative rare event, etc. The sequential nature of experience, the time it takes to gather information, and more importantly, the active role played by the subject increase the degree of involvement with the task. These characteristics are absent, or at least less vivid, when information is obtained in the form of a description.

3.3 Illusion of control

People tend to act as if they can control outcomes in situations that are governed purely by chance. Langer (1975) proposed that people confuse luck with skill, and therefore, chance situations that present characteristics commonly observed in skill situations induce “illusions of control”: exaggerations of the probability of success based on overestimations of personal control.

To show this, most research on illusion of control has used pure chance tasks, where outcomes are completely unrelated to the actions taken by the subjects. The most common type of tasks involves gambling games of cards, dice or lotteries. In these tasks, people are expected to express the amount that they are willing to bet on an outcome or asked to rate their degree of confidence on a successful outcome. Other tasks involve subjects pressing buttons that turn a light on in a random fashion. In these cases, subjects are told that they have control over the light and that they would be rewarded for turning it on. In these studies, the dependent measure is the subject’s estimated control over the light.

In skill situations, people engage in activities that lead to increase the chances of success, for example, getting familiar with the task and materials, making choices, and being actively involved in the task. Success in tasks that involve skill is influenced by other factors. Namely, the apparent skill of one's opponent is an indicator of the chances of one's own success. Another example is foreknowledge, since in most skill tasks people know their goals and the actions that lead to them.

A number of other factors were found to influence illusion of control, like emphasizing success in random tasks. Langer and Roth (1975) manipulated the frequency of successful outcomes in a coin toss game. Subjects that observed a streak of successes early in the sequence believed that they were good at guessing the outcome, and reported an illusion of control over future tosses. Similarly, Tennen and Sharp (1983) showed that in a random task in which the chances of a successful outcome are high, and repeated outcomes reinforce success, illusion of control is higher than in tasks where the positive outcome is less frequent. In contrast, while the reinforcement of successful outcomes induces illusions of control, reinforcing failures may reduce it, suggesting a "learned helplessness" (Matute, 1994).

Another factor that has been found to increase illusion of control is the need for the outcome. Biner, Angle, Park, Mellinger and Barber (1995) showed that hungry subjects, who had fasted before the experiment, revealed higher illusion of control in a lottery with a hamburger as a prize than subjects who were not as hungry. A similar result was obtained by Friedland, Keinan, and Regev (1992) who reported high illusion of control in subjects under stressful situations, who were therefore expected to seek control.

Though the original explanation for the illusion of control was Langer's (1975) formulation that people confuse skill and chance situations, another framework that explains this bias is a motivational account from social psychology (Alloy & Abramson, 1979; Alloy & Clements, 1992; Fitch, 1970; Johnson, Feigenbaum, & Weiby, 1964; Langer & Roth, 1975; Wortman, Costanzo, & Witt, 1973). In several experiments, researchers found that subjects generally attributed causality to themselves when they succeeded at the task and to chance when they failed.

The explanation is that people are motivated to maintain or enhance self-esteem. Taking credit for good outcomes maintains or enhances self-esteem and blaming others (or other factors outside their control) for bad outcomes does not damage to self-esteem. Alloy and Abramson (1979) tested judgments of contingency made by depressed and non-depressed college students. Results revealed that, whereas depressed students showed no illusion of control, non-depressed students showed illusion of control for desired outcomes, as if to maintain or enhance self-esteem, but showed no illusion of control for undesired outcomes, as if to prevent hurting their self-esteem.

One way in which the illusion of control is manifested is by the tendency of subjects to prefer to be in charge of performing a task themselves instead of others when they believe they have control over the outcome. For example, in Langer and Roth (1975) subjects thought they would be more successful (exert higher control) in a card game of chance if they drew the cards themselves than if they were drawn by other. According to the view that people judge control over random events because they seek to protect or enhance their self-esteem, subjects are expected to invest more resources in situations in which they are asked to activate a random task themselves than in a situation where the random task is activated by somebody else. For example, if a task involves pulling out a token from a bag that contains 9 tokens that pay a positive amount and one token that pays nothing, subjects would be willing to pay a higher amount of money to draw the token themselves than when the token is drawn by somebody else.

3.4 Description-experience gap and the illusion of control

Small-probability events have been shown to be underweighted when their frequency of occurrence is learned from experience and overweighted when learned from description. In the token example described in the previous section, subjects that sample the lottery from experience would underweight the chances of pulling out the non-paying token, and therefore would be willing to pay a higher amount to play the lottery than subjects that learn about the lottery from description, who would find the gamble less attractive as they overweight the probability of getting the non-paying token.

According to the self-esteem hypothesis that explains illusion of control, subjects facing an attractive lottery would be willing to draw the token themselves, taking credit of a probable gain and fueling their self-esteem. Conversely, as the lottery becomes less attractive, subjects would prefer somebody else to draw the token to avoid a possible loss that would damage their self-esteem. Therefore, the amount that a subject would be willing to pay to play this lottery would depend on the interaction between the source of information (description or experience) and the person in charge of drawing the token out of the bag (oneself or other).

3.5 Hypotheses

It is expected that, when information about the lottery is obtained from experience, the chances of getting the non-paying token is given less importance than it deserves, making the lottery more attractive than it objectively is. By sampling from this lottery, subjects may not only observe a more favorable lottery than it objectively is, but also become familiar and involved with the task, fueling their illusion of control. Therefore, because subjects want to improve their self-esteem, they would prefer to draw the token out of the bag themselves rather than somebody else, in order to take credit from a perceived likely gain. Conversely, if the lottery is learned from description, the chances of getting the non-paying token will be overweighted and the lottery would be perceived as less attractive than it objectively is. Also, the sense of involvement and familiarity with the task when learned from description would be less significant than when the task is learned from experience. Because subjects want to protect their self esteem, and because they perceive the non-paying outcome as more likely than it is, they would prefer to avoid the responsibility for a possible failure, and prefer somebody else to draw the token than to draw it themselves. Table 1 shows the predictions according to the interaction described. The cells in the table show the amount that the subjects would be willing to pay to play the lottery described before.

Table 1

Predictions derived from the interaction between source of information and illusion of control

		Source of information	
		Experience	**Description**
Person to draw the token out of the bag	**Oneself**	High	Low
	Other	Low	High

3.6 Methods

The experiment is a 2x2 between-subject design. Participants are assigned to one of four conditions that differ in whether they learn about a lottery from description or experience and whether the lottery is played by themselves or by the experimenter (self-draw or experimenter-draw). Participants performed two tasks: a simple choice problem designed to earn game money and an inference task in which participants state their willingness to pay (WTP) to play a lottery.

a) Participants

Eighty-six volunteers, 53 women and 33 men evenly distributed among the four conditions, served as paid participants in this study. Participants were undergraduate students from various backgrounds at Universitat Pompeu Fabra, Spain.

b) Apparatus and procedure

The experiment was run in a computerized laboratory in eight successive sessions with a median of eleven participants in each session. Participants entered the laboratory and sat in front of a computer screen for the first task, which did not vary across conditions. The first task involved a one-shot choice between 10€ for sure and 12€ with 30% probability or 0€ otherwise. The objective of this task is two-fold. On the one hand, by having participants earn their game money, we reduce the influence of a house-money effect on risk-taking behavior. On the other hand, by setting a riskless option of 10€ objectively –and exaggeratedly—more favorable than a risky option of 12€, we expect to have most participants move to the second task with constant earnings and therefore constant reference points which facilitates the analysis.

The second task involved expressing the WTP to play a lottery that pays 10€ with probability 0.9 and 0€ otherwise. This task differs from previous tasks used in studies of illusion of control because it involves high probability of winning, whereas most tasks used in other studies involved small probability of winning. In previous studies, control is revealed by people overestimating their probability of winning, while in the current task, control would be revealed by an underestimation of the probability of not gaining 10€. The reason to make the positive gain so probable is that emphasis on success has shown to increase the illusions of control (Langer and Roth, 1975).

The procedure to elicit the WTP followed the Becker, de Groot and Marschak (1964) method for incentive compatibility. In this method, participants are asked to express their maximum WTP for a risky lottery. Their WTP is then compared to the price of the lottery, which is a random number between the highest and lowest outcomes of the risky lottery. If the stated WTP is higher than or equal to the randomly drawn price, the participant pays the price and plays the lottery. Otherwise the participant pays nothing and does not play the lottery.

After the first task, the experimenter calls the attention of all participants and shows them ten lottery tickets priced from 1€[2] to 10€. The experimenter then shuffles the tickets and asks for a volunteer to select one ticket at random and sign its back without looking at its price. All participants become aware that one ticket was drawn at random but none knows its price.

The second task of the experiment is done individually in the experimenter's office, which is located inside the laboratory but in a separate room. For each participant in the four conditions, the experimenter reads aloud the following instructions:

> "You have won 10€ (0€ or 12€) in the first part of the experiment. This money is yours. Now, the experiment consists of the following game, the bag that you see on the table has tokens inside, these can be red or black. The game consists of withdrawing one token from the bag without looking. If the token withdrawn is red, the university will pay you 10€, while if the token is black the university will pay you nothing. To play this lottery it is necessary to purchase a ticket, but you do not know the price of the ticket. In fact, you saw the price drawn at random by a volunteer in the first part of the experiment. Your task is to offer the amount that you would be willing to pay to purchase a ticket to play the lottery. If your offer is higher than or equal to its price, you will pay the price and play the lottery. Otherwise, you will not be able to play the lottery. Before expressing your willingness to pay …"

In the rest of the experiment, instructions differed across conditions. In the description condition, the instructions followed:

"… I will show you the content of the bag." The experimenter empties the content of the bag on top of the table and reveals 9 red tokens and 1 black.

In the experience condition, the instructions followed:

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[2] Though the lottery's lowest payoff was 0€, we used 1€ as the lowest ticket price to avoid confusion with the possible zero-cost of the lottery. This change does not alter the incentive compatibility in the Becker-de Groot-Marschak method.

> "… I will let you play the game as many times as you like, but without monetary remuneration. The goal is that you learn the content of the bag such that you can estimate the amount that you are willing to pay to play the game for real money. You can withdraw as many tokens as you like, one by one, always letting the experimenter put the token back in the bag before you draw again. You must tell the experimenter when you have sampled enough".

The participants then sampled the lottery as much as they wanted.

After the participants had seen the content of the bag (description) and sampled the lottery sufficiently (experience), they answered in a written form, one of the two following questions provided also in a written form:

- Self-draw (DS condition): "¿How much are you willing to pay for a ticket to play this game, taking into account that you will draw the token out of the bag?"

- Experimenter-draw (DE condition): "¿How much are you willing to pay for a ticket to play this game, taking into account that the experimenter will draw the token out of the bag?"

The materials used in the experiment were casino tokens and a dark brown cotton bag that did not allow participants to see the tokens inside. Lottery tickets were designed in paper to resemble real lottery tickets. A laboratory assistant recorded all experimental results.

c) Compensation

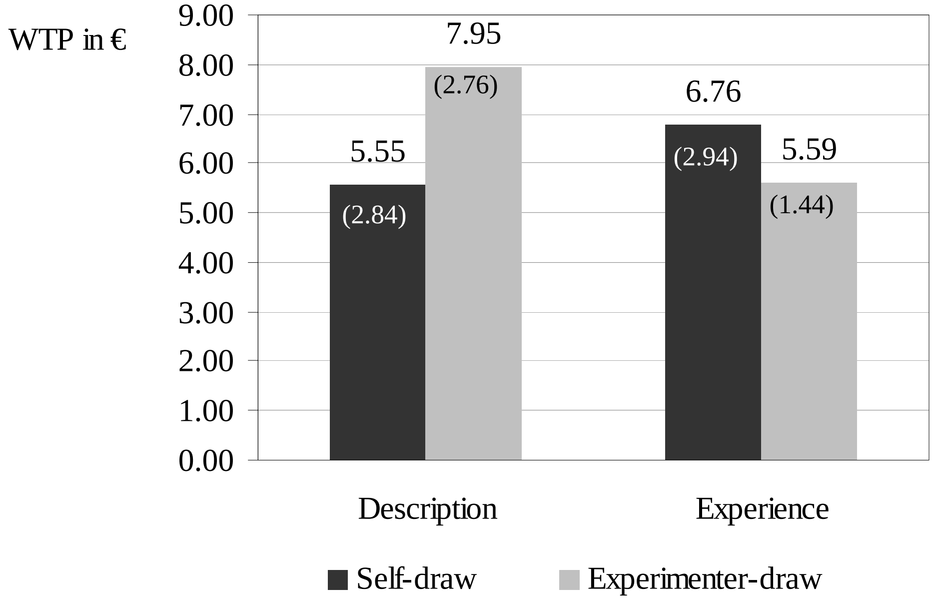
Participants did not receive a show-up fee but were paid for the payoffs in the first and second task. When the participant's WTP in the second task was lower than the random price of the lottery, the compensation was equal to the payoff in the first task. Otherwise, the compensation was the payoff of the first task minus the random price plus the payoff of the lottery. The mean compensation was 12.10€.

3.7 Results

As expected, 83 participants chose the safe 10€-option in the first task, while three participants chose the risky lottery and obtained 0€. These participants were removed from the analysis as their WTP was elicited from a different reference point than the majority of participants. The final sample consisted of 83 participants: 20 participants in the DE condition, 20 in DS, 22 in EE, and 21 in ES.

ANOVA results show a significant interaction between source of knowledge and illusion of control (df = 82, F = 4.03; p = .010). Figure 1 shows that in the description condition, participants were, on average, willing to pay a significantly higher amount to play the lottery when the token was drawn by the experimenter (7.95€; SD = 2.76) than when it was drawn by themselves (5.55€; SD = 2.84), revealing the self-serving tendency to protect self-esteem from the undesired black token. The opposite is observed in the experience condition, where results show a preference to take control over the lottery, as participants became involved with the task and as the undesired rare event was underweighted. In this condition, participants were willing to pay a mean of 6.76€ (SD = 2.98) when the token what drawn by themselves and a mean of 5.59€ (SD = 1.44) when the token was drawn by the experimenter.

Figure 1. WTP in the four experimental conditions



Note: standard deviations in parentheses

Results show that underweighting of rare events in experience can be extended from a choice task to a WTP measure. If we compare the results from description and experience when the token is drawn by the participant, as it is done in previous studies of choice where participants sample and choose by themselves, we see that underweighting in experience makes the lottery more attractive and leads to higher WTP than in description (diff = -1.21; t = -1.39; p = 0.09; one-tailed, unpaired t-test). This relatively slim difference is affected by the revealed ambiguity avoidance, a tendency to bet higher on lotteries with known probabilities than with unknown, ambiguous, probabilities (Fox & Tversky, 1995).

a) Sample sizes in experience

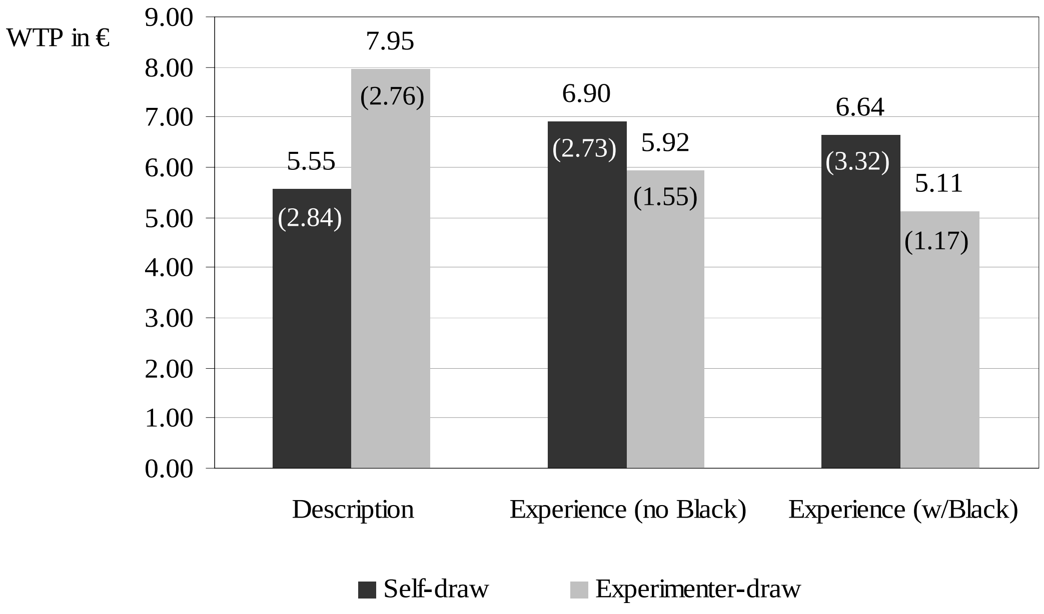
The mean sample size was 5.16 draws (SD = 1.82) and the median was 5. These samples are strikingly smaller than those observed in previous studies (half of the medians per problem of 15 and 17 in Hertwig et al., 2004 and Weber et al., 2004). This finding is relevant because the task studied is not a choice task, where small samples may amplify the differences and render choice simpler (Hertwig & Pleskac, 2008). In the current context, small samples are objectively misleading. The relevance of this result is emphasized as subjects sampled from only one lottery, and not from many lotteries as in previous studies (more than 12 in studies of 6 problems of binary choice). This result provides additional evidence that the probabilistic approach to experience-based tasks fails to fully explain the psychological phenomena behind sampling.

One important aspect of the current sampling design is that it resembles a realistic sampling process. In this case, sampling was not as costless as in previous studies where draws were done by clicking on a button. The process of sampling in this study involved participants putting their hand in a bag without looking and pulling out a token. The experimenter would then get the token back from the participant, put it back in the bag and shake the bag to shuffle the tokens, to start the process again. Therefore, the process of sampling may have appeared more costly than in previous studies, which could have limited sample size. Yet, it should be born in mind that, if sampling tends to be more limited outside the laboratory than in an experimental setting, sample size of real-world observed phenomena would then be trivial.

b) Higher perceived risk does not lead to change in risk taking

Considering the observed probability of encountering the black token as the number of encounters with the black token divided by the sample size, then all participants that encountered the black token at least once, observed a probability higher than the objective probability seen by participants in the description condition. Of the 43 participants from experience, 23 never encountered the black token while 20 did encounter it. Since all participants that encountered the black token sampled less than 10 times, the chance of getting the black token was overrepresented in their samples. The mean observed probability of those that encountered the black token was 0.24 (N = 20, SD = 0.10) and 0 of those that never encountered it. Yet, WTP to play the lottery was strikingly similar between these two groups from experience (Figure 2). Though the overall WTP did not change significantly, higher perceived risk led to a more marked illusion of control. Notably, as the risk of getting the black token increased, participants were more willing to draw the token themselves.

Figure 2. WTP in samples of differently observed probabilities



Note: standard deviations in parentheses

3.8 Discussion and conclusion

Results from this study suggest that underweighting of rare events in experience-based tasks can be mediated by illusion of control and not entirely by a probabilistic evaluation of outcomes in relation to a sample size. Illusion of control mediated the influence of the source of information on the dependent measure, in this case, an expression of WTP. The current pattern of underweighting in experience and overweighting in description was replicated when the participants were responsible for drawing the tokens themselves. However, the opposite holds for the cases when the random draw was carried out by the experimenter. In description, overweighting the chances of an undesired outcome revealed a preference towards avoiding the responsibility of drawing the black token, which could damage self-esteem. In the experience condition, the naturalistic nature of the sampling process made participants become involved with the task, increasing familiarity and spending time with it, thereby fueling the feeling of control. In this case, participants preferred to draw the token themselves, especially when perceived risk was higher.

We suspect that the self-esteem hypothesis is favored by the fact that, in case participants' WTP was higher than the random price of the lottery, they would have to play for real money in the presence of the experimenter and the laboratory assistant. This public exposure may exaggerate the influence of the lottery outcome on the participant's self-esteem. It is possible that a loss would be more damaging to self-esteem if it happened in public than if it happened in private.

These findings are particularly interesting for managerial decision making. Imagine a CEO who has to assign an important project involving risky investment decisions to one of his top managers. Our findings suggest that depending on the way the potential candidates learn about the project they will develop a different sense of control over the project, and hence the willingness to invest money and resources in it will differ. A manager learning about the project through a detailed presentation of the potential gains and losses may not be confident enough to invest sufficiently, while someone with experience in the particular type of project may feel able to control such endeavor and therefore be willing to risk more money.

Our results, together with recent finding in this field, suggest that the probabilistic approach to experience-based tasks is incomplete. Other psychological phenomena seem to occur in the process of sampling; phenomena that relate more closely to the subjective “hunches” provided by repeated events than by its purely objective meaning (Bechara, Damasio, Damasio & Anderson, 1994). It is important, therefore, to bear in mind that, as different degrees of self-esteem can moderate the effect of illusion of control, other personality traits may also interact in the process of learning from experience. For example, whether people have an internal or external “locus of control” (Hong & Chiu, 1988) can have a significant influence on the degree of control they perceive to have over a random process. This aspect can be explored in future research.

3.9 References

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