

Gender differences towards risk and ambiguity environments: an experiment.

Abstract: Gender differences can be found in different social domains. Particularly, the present project is focused on the study of gender differences towards risk and ambiguity environments. The majority of the literature suggests, in the first place, that gender differences can be found under risk condition, being males more risk prone than females. Secondly, gender differences are not significant under ambiguity condition. In this paper, takes place an experimental study measuring gender differences through both conditions. The results show -as the majority of the literature propose- that females tend to be more risk averse than men. Nevertheless, the results also suggest that despite there is not correlation between the different attitudes measured for both conditions, there is a high correlation between subjects classified as risk consistent and ambiguity consistent.

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1. Introduction

Gender differences is a topic of which great magnitude of research and investigation have been done, due to the amount of domains where these kind of differences can be found: work environment, society, education, health or economics environments.

On the one hand, Blau and Kahn (2000) affirm that even though the last years labour policies have been promoting a higher integration of the women's figure into the work world, in many families, women are who support the principal responsibility as taking care of kids and housework. In addition, they confirm that in spite of the real discrimination which affects straightaway to women in the labour market, the wage gap will be progressively diminishing over the years. On the other hand, Niederle and Vesterlund (2007) expose that men are more overconfident than women. This is one of the reasons about women's role has not weight in work positions with a great capacity of competition needed.

A great number of studies developed¹, reveal the fact that men tend to be more confident than women. In addition, Eckel and Wilson (2004) affirm that the women's behaviour usually, changes quicker than men's. Over the years, the women's role has been gaining more weight, and gradually decreasing gender differences in the majority of the quotidian activities. Currently, it is easy to find women employed in a leading position in different sectors.

According to different studies, women tend to be more patient and more likely to measure risk at each process of decision. Through a series of questionnaires which includes four different domains: gambles, free time, health and social decisions, Harris, Jenkins and Glaser (2006) observe gender differences over each domain. Their results conclude that men are more risk prone for the first three domains (gambles, free time and health), while under social decisions domain, no significant gender differences are found.

In a different research, Gneezy, Niederle and Rustichini (2003) conclude after developing an experimental study that men react easily in front of competition than

¹ See Snijders and Keren (2001), Buchan, Croson and Solnick (2008) and Eckel and Wilson (2004).

women. They emphasise that there is sufficient empirical evidence about under scenarios where the best subject on the group is rewarded, males tend to over exert more than males. Following with the theme of preferences in competition, Comeig et al. (2015) also investigate gender differences under competitive environments, and it came as a result that the choice of entering competition is not only related with gender differences, influencing other conditions too. For example, women also decide to enter in competition environments according to their own risk attitudes and sports competition experience.

The largest part of the literature that treats about gender differences expose the generalised fact that women tend to present more risk averse attitudes than men do. Attitudes toward risk in economic environments have been examined for a long time, and this is why it is possible to find a large amount of investigations and experimental studies which are about gender differences in decision making.

Different authors, as Crosson and Gneezy (2009) or Eckel and Grossman (2008), have focus their work in revising the existence of literature which is based in gender differences towards risk attitudes. The second ones, conclude that women are predominantly more risk averse than men. Nevertheless, they affirm that in many occasions, experimental study may present biasing information due to the existence of different factors which are not considered in the experiment, such as marital status, wealth or knowledge. In addition, experimental results would be different according to the methodology used for the experimental design: type of payment, probability and level of risk assume by each subject. Related to Crosson and Gneezy (2009) literature's revision, suggest similar results as previously commented, men tend to be more risk prone than women, and this is because women give a higher degree of importance to social signals than men do.

On the one hand, authors as Croson and Gneexzy (2009) exhibit that females have a great risk aversion than men, and they suggest that this is due to the fact that there are different factors such as emotions and overconfidence: females give priority to their own feelings when they have to make risk decisions and in contrast, males tend to be more overconfident.

On the other hand, Powell and Ansic (1997) conclude that gender differences under risk environments are linked with different election strategies: females focus their own strategies in feeling secure and eliminating the worst scenario possible, in contrast, men tend to use strategies in order to obtain the highest payoff. In a following research, Powell and Ansic (1999) propose a study of the factors which affect attitudes towards

risk as a method to explain gender differences in financial markets. Some of the factors studied here are, trust, risk perception and risk appetite in the domain of financial decisions. Their results confirm that gender is a variable to consider, and they add the fact that women present a higher perception of risk in comparison with men. This conclusion might be an explanation that women often have in their financial assets less risky assets than men.

Jinapoulos and Bernasek (1998) conduct an econometric study using different variables such as age, employment, education, marital status and race in order to estimate gender differences in risk aversion attitudes. Their findings conclude that single women tend to be more averse than unmarried men. In addition, risk aversion decreases as long as wealth increases in the household (descending faster in the case of men than women). Furthermore, black women tend to be even more risk averse. From another point of view, Byrnes, Miller and Schafer (1999), suggest that gender differences changes according to the age and the context in which each person is. In risky environments, gender differences are higher than in scenarios less committed.

Following the theories about the existence of gender differences under attitudes towards risk. García-Gallego, Georgantzís and Jaramillo-Gutierrez (2009), expose that women show to be more risk averse than men. This paper follows the methodology previously introduced by Sabater-Grande and Georgantzís (2002), where the expected payoffs increased linearly through four panels of lotteries. In an experimental study using the ultimatum game under the context of wage negotiations employer-employee, García-Gallego, Georgantzís and Jaramillo-Gutierrez (2012), obtain different results as exposes the rest of the literature analysed. Although a greater risk aversion is confirmed in women, from the point of view of an employee negotiating their salary, the existence of gender differences in decision making it is not due to risk aversion attitudes.

Regarding to the research about decision-making groups, Cadsby and Maynes (2005) conduct an experimental study in which women and men are separated in different groups. Subjects in each group have to make joint decision. Under this environment, it is observed that although women are more risk averse, when they are making group decisions tend to perform in a similar way to other individuals. A higher coordination between subjects can be observed when those groups are formed by females.

In contrast to the majority of the literature existent about attitudes toward risk, Meier-Pesti (2005) connect risk aversion with femininity, exposing that sometimes there are probabilities that some men may have feminine traits (and vice versa). For that reason,

sometimes taking into consideration the gender of each subject can underestimate the effect of risk attitudes analysed.

After having analysed part of the literature about gender differences in risk environments. It is also significant to emphasise the literature about ambiguity or uncertainty scenarios. In their paper, Etner, Jeleva and Tallon (2012) summarize some of the approaches used to measure ambiguity attitudes and the problems that this entails. They conclude that the subject's behaviour under decisions towards ambiguity responds to different attitudes presents in riskier scenarios. And it is needed the development of further researches so new answers could be found.

Under the ambiguity scenario, experiments are designed in a way that these subjects are in scenarios where the probabilities of occurrence are not always known. There is an unknown part which represents the ambiguity. Borghans et al. (2009) expose the fact that risk and ambiguity scenarios depend on different variables. Psychological factors have significance in risk attitudes but not in attitudes towards ambiguity and that is because women have been always classified as risk averse subjects. In their results, after running an experimental, reveal that the higher uncertainty presented, the lower gender differences are found. Similar characteristics are exhibited in others investigations, for example Cohen, Jaffray and Said (1985) and Cohen, Tallon and Vergnaud (2009) show that the variables which measure attitudes towards risk and ambiguity are not correlated between them.

After performing an experimental study about ambiguity aversion, Viscusi and Chesson (1999) conclude that ambiguity aversion is only present when the probabilities to earn the highest amount of money are high. Subjects tend to prefer higher levels of ambiguity when the probabilities of earn are low. These results are consistent with those already mentioned by Borghans et al (2010). They include gender differences and expose the existence of these differences with high ambiguity. However, under low ambiguity men and women act in a similar way.

It is possible to find different researches comparing attitudes towards ambiguity when subjects have to make group decisions. Studies as, Curley, Yates and Abrams (1986), or Muthukrishnan, Wathieu and Xu (2009) find that individuals who have to make decisions in group tend to be more ambiguity averse than taking the decision by themselves. However, Keck, Diecidue and Budescu (2014) conduct a similar experimental study and show completely different results, claiming that under group decisions, decisions are made more neutral while individual decisions tend to be more

ambiguity averse. That means, the neutral individuals can persuade with their own opinions to that subjects classified as averse.

As it can be observed, after this review of the literature existent, many studies and research have been conducted in this field for a long period of time. The general conclusions that could be mentioned are, on the one hand, that risk aversion attitudes are significantly higher in women than in men. On the other hand, besides the fact that attitudes under ambiguity does not present any gender differences in comparison to risk attitudes, risk and ambiguity attitudes are not correlated to each other.

The main objective of this project is to observe through an experiment study with real payoffs the possible existence of gender differences in decision making under risk scenarios and ambiguity scenarios, and taking into consideration the differences between both scenarios (risk and ambiguity).

An experimental study is performed following the method used by Blavatsky (2009). It is divided in two different parts, one part takes into consideration risk attitudes, and the second part attitudes towards ambiguity. In this context, different scenarios are played by the subjects, some of them measuring risk attitudes and the other one's ambiguity attitudes. The experiment is designed in a way where each subject will play nine risky scenarios and nine ambiguous scenarios. In the scenario which measure risky attitudes, it is presented by two options with the same probability of occurrence: a safer option and a riskier option. Based on these decisions it will be possible to classify each subject as risk averse, risk neutral or risk loving.

The second part in which the experiment is divided, is based on measure the attitudes taken by individuals under ambiguity scenarios. Under this condition, the payoffs are equal in the two options presented, but in one of them, the probability to earn is unknown. Based on these decisions it will be possible to classify each subject as ambiguity averse, ambiguity neutral or ambiguity loving.

As most literature exhibits, the results show a higher incidence of gender variable under decisions involving risk than those involving ambiguity. In this context, only significant gender differences have been found in the variables of risk aversion and neutrality. On the other hand, an interesting result it is found. Given the correlations between different attitudes it can be observed that ambiguity and risk variables have not any correlation. It is observed that although a subject is classified as risk averse, does not have to be ambiguity averse, although it is found that most our subjects are risk averse and ambiguity averse.

The structure of this paper is organized as follows. After an explanation of the central theme of this project, a brief review of the literature has been illustrated on it. In the next section it is explained the methodology and the characteristics of the experimental study developed. After the explanation of the experimental design, the following section presents the different results obtained from this experiment, and finally a conclusion about it. Also in the appendix are presented the instructions that were given before each experimental session to the subjects.

2. Experimental design

The aim of this project is focused on measuring gender differences that exist in decision making which involves the existence of risk and ambiguity environments. In order to obtain the expected results, an experiment with real payoffs is developed. In that experiment participated 104 subjects, being the proportion of males and females the same: 52 males and 52 females.

This experiment is divided in two different parts, in each one of them, each subject dealt with different situations represented by 9 pairs of lotteries which will measure on the one hand risk attitudes, and on the other hand ambiguity attitudes. At the end of both sessions performed, the subjects will have been taken part in 18 different scenarios². In order to measure attitudes towards risk and ambiguity, a method previously introduced by Blavastsky (2009) and Holt and Laury (2002) is used.

Throughout the whole experiment, each subject deal with different situations represented by cards. The card background colour (blue or yellow) determine the probability played in each of the different stages. In both of the two sessions perform, subjects face with two different conditions.

In this risk condition, all the information is displayed on the screen and both of the situations represent have the same probabilities to occur. The only difference between the two situations is the amount that would be earned. The real payoffs used are represented in Table 1. As it can be seen, there is a riskier option and a safer option, in the riskier option the amount to earn is 4 euros versus 0.10 euros, and in the safer option the payoffs are 2 euros versus 1.60 euros. In this first part of the experiment, riskier and safer options are exchanged from right to left side of the screen to avoid the *right-left effect*.

² The instructions given to each subject at the beginning of the experiment are in the Appendix section. pp: 28-30

Table 1: Payoffs of risk condition

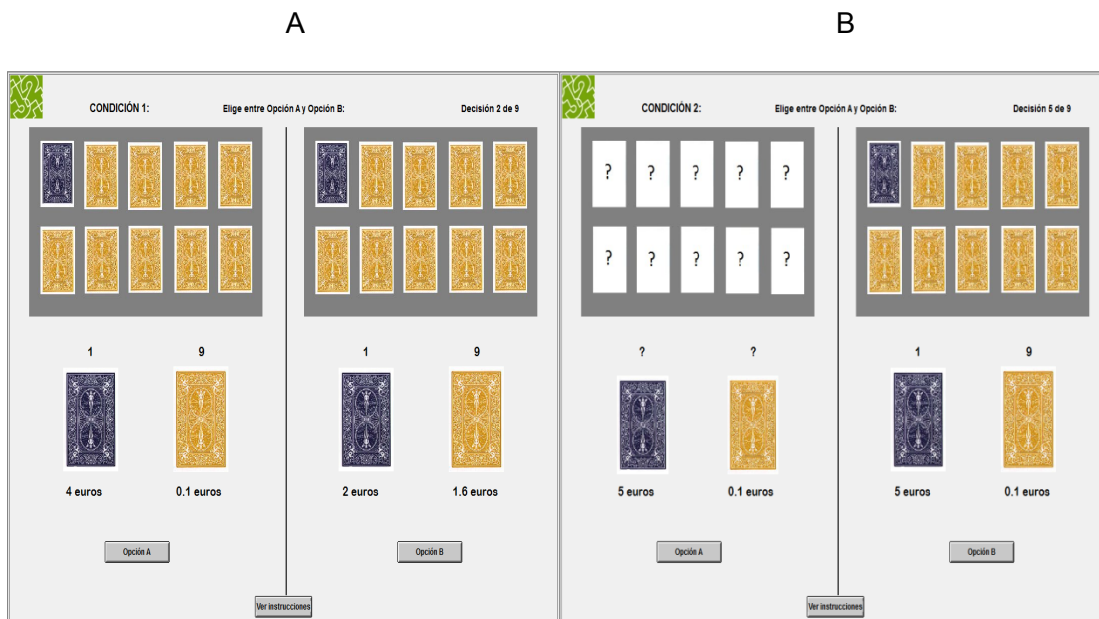
Safer option	Riskier option
Blue card: 2€	Blue card: 4€
Yellow card: 1,60€	Yellow card: 0.1€

In the second condition represented during the experiment, it is measured the effect of the ambiguity or uncertainty. Under this condition, the possibility related to the quantity of euros that the subject would earn in the two options showed on the screen is the same. However, in one these options, the probability -represented by blue and yellow cards- is different and unknown, it leads to think that there is missing information. The ambiguity –under this condition- does not allow you to know if the probability to earn more money is higher than in the known option. As well as in the condition under risk, the ambiguous and unambiguous options are placed alternating their position on the screen between the left and the right side.

Observing the examples showed below in Figure 1, in picture (A) is displayed an example about one possible scenario under risk condition. Equally in the left side and in the right side the probability to earn the highest amount of money (blue card) is 1/10 compared with the probability to earn the lower amount of money (yellow card). It is conceived the safer option as the option whose profits are 2 euros for the blue card and 1.60 euros for the yellow card, and as the riskier option that whose profits are 4 euros for the blue card and 0.10 euros for the yellow card. The probability to earn the highest quantity of money varies from one scenario to other. Besides, depending in which point of probability each subject changes its own choice from the safer option to the riskier option, it will allow us to classify if that subject is averse, neutral or risk loving.

The picture (B) in Figure 1 shows the ambiguity scenario. In this case, the visible option displays that the probability to earn the highest amount of money is 1/10, compared to earn the same amount of money but with an unknown probability (ambiguity). Depending the point in which each subject decides to change from ambiguity scenario to the option with the known probability (unambiguous scenario), it will determine if that subject is averse, neutral or ambiguity loving.

Figure 1: risk (A) and ambiguity (B) scenarios



As it has been explained earlier, a total of 18 pairs of lotteries are played by each subject throughout the experiment, nine of them are about risk attitudes and the other nine about ambiguity attitudes. All the cards used during the experiment are previously introduced in the computer programme, in which the nine pairs of lotteries appear with all the possible probabilities in steps of 10%. From 10% to appear the blue card and 90% to appear yellow card, to a 90% to earn the blue card's payoff and a 10% the yellow's. However, it should be emphasized that these nine pairs of lotteries do not appear ordered on the screen, their appearance is randomly chosen to discard the *order effect*.

In addition, the order in which both conditions (risk and ambiguity) are introduced, could be different for each subject, it means that a subject can start with the nine pairs of lotteries which measure attitudes toward uncertainty and then, start with the risk condition; and another subject can start with the risk condition firstly, and later with the ambiguity condition.

As soon as the results of the experiment are obtained about the 104 participants, and following Comeig, Jaramillo-Gutiérrez and Ramirez (2013), the Unique Switching Point (USP) is calculated for each subject and condition. On the one hand, the calculation for the risk scenario. Firstly, the maximum probability at which each subject has chosen the safer option is calculated, and secondly, it is compared with the minimum probability at which each subject has chosen the riskier option (which symbolise the blue cards). If the maximum probability at which each subject chooses the safer option

is lower than the minimum probability chosen in the riskier option, the subject would have an USP, its decisions would have been consistent in risk attitudes and then it would be suitable to perform the analysis of results.

On the other hand, to calculate the USP under the ambiguity condition a similar two-steps process it is done. Firstly, the maximum probability at which each subject has chosen the ambiguity option is calculated, and secondly, it is compared with the minimum probability at which that subject has chosen the unambiguous option. If the maximum probability chosen in the ambiguous option is lower than the minimum probability at which the subject chooses the unambiguous option, the subject would have an USP and this decision would be consistent in ambiguity attitudes. Due to the fact that risk and ambiguity are two totally different scenarios, a subject would be considered such a risk consistent but ambiguity inconsistent and vice versa.

As it has been mentioned previously, for being able to measure both risk and ambiguity attitudes, it has been employed the method introduced before by Holt and Laury (2002), and afterwards used by Blavatsky (2009). In the risk scenario, each subject is free to choose between riskier lotteries or safer ones. In the present study, it is considered that a subject is risk averse when his choice of the safer option goes from the first probability (10% blue card and 90% yellow card) to choose the safer option at least when the probability is 60% for blue cards and 40% for yellow cards. A subject would be denominated as risk neutral when the change from safer option to the riskier option occurs on the probability of 40% blue and 60% yellow card or 50% blue and 50% yellow card. At last, a subject classified as risk loving, would choose the risk option until the probability of 30% blue card and 70% yellow card. Besides, it would be possible to classify a subject as risk loving if all its decisions include the risk option.

A similar method is used to measure attitudes toward ambiguity. Firstly, a subject is classified as ambiguity averse when his choice never includes the ambiguity option, and in the event to do so, only until the probability that indicates 40% blue card and 60% yellow card. Secondly, a subject classification as risk neutral would carry out the change from ambiguous option to unambiguous option at the probability of 50%-50%. Finally, the subjects classified as ambiguity loving would choose the ambiguity option at least until a 60% blue card and 40% yellow card of probability.

The experiment is performed through two different sessions in which 104 students participated (52 males and 52 females), enrolled at the Universidad de Valencia and studying all of bachelor's degree relate whit economy. Both session happen at LINEEX, the Laboratory for Research in Experimental Economics hold on the

Universidad de Valencia. Each session last approximately about one hour and the average age is 22 years old. The recruitment it is developed through its electronic service. LINEEX has a computerised database in which previously has enrolled the participants. The minimum payoff is over 5€, because there is a fixed payoff that subjects got only for attend to the experiment.

During the time that the experiment is in process, it is not allowed the communication between the different subjects. At the beginning of each, a detailed explanation is given about the different tasks that are going to be done and the different doubts which subjects have, are answered. All participants of the experiment are informed that at the end of the experiment, the final payoff would be randomly chosen within one pair of lotteries of both conditions (risk and ambiguity).

3. Results

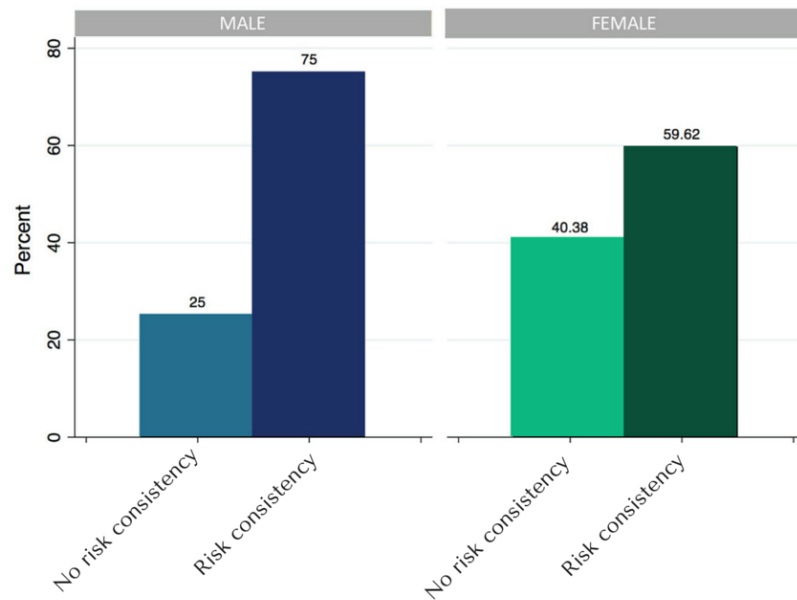
Moving forward to this section, an analysis of the results - obtained after the performance of the experiment described in the previous section- will be conducted. The purpose of this analysis is to identify how far it could be affirmed the existence of gender differences under decision making about risk and ambiguity scenarios. In addition, another objective could be described as the observation of the results verifying whether these are adjusted according the literature previously mentioned in the introduction. In light of that, it has been conducted descriptive statistics, a correlation test and an estimation of a logit regression.

First of all, the subjects are classified according to their consistency in risk and in ambiguity attitudes. When a subject is classified as risk or ambiguity consistent, it means that its behavioural patterns only change once from the safer option to the riskier option (in the situation of risk) or from ambiguous option to the unambiguous option (in the case of ambiguity). These subjects are denominated as consistent in risk and those who do not reach those requirements –denominated as risk or ambiguity inconsistent- will not be taken into consideration in the current analysis.

The results show that between the 104 subjects that participated in the experiment, only a 67.30% present consistent behaviour towards risk condition. Figure 2 displays graphically gender differences under risk consistency attitudes. The percentage of consistency in males is 75%, higher than the percentage of women's consistency, which is 59.62%. In this particular case, after the execution of a proportional test, it is possible to reject the null hypothesis - with a 5% significance – which said that both

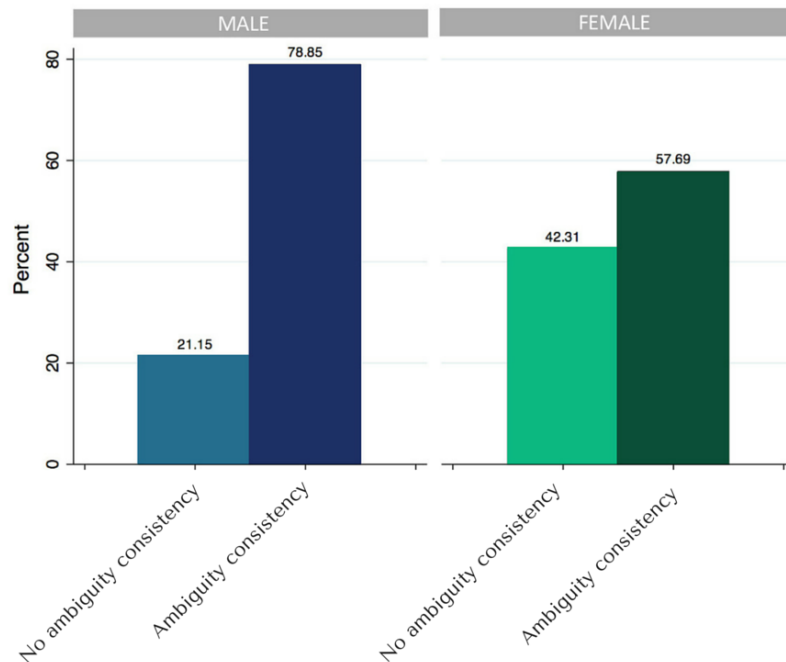
men and women are equals under risk consistency classification with a p-value equal to 0.048.

Figure 2: Percentage of risk consistency by gender



Following with the classification of consistency attitudes, Figure 3 shows ambiguity consistency by gender. From the 104 participants, only the 68.26% exhibit consistent attitudes towards ambiguity condition. In addition, the percentage of women classified as ambiguity consistent is lower than under risk condition with a 57.69% compared with the 78.85% of consistent men. In this particular case, after making the corresponding proportional test, it would be plausible to reject the null hypothesis –with a significance at 5% level and a p-value of 0.010. Claiming that both men and women have significant differences in relation to ambiguity consistency attitudes. Contrasting the results over risk consistency and ambiguity consistency, it is observed that gender differences are specially more significant in the second one.

Figure 3: Percentage of ambiguity consistency by gender



With the data obtained, it is performed a correlation test –using Spearman’s Rank Correlation- in order to confirm the existence of some kind of relation between risk consistency and ambiguity consistency variables, considering at the same time the gender of each subject.

In Table 2 is reflected the results of the correlation test between risk consistency, ambiguity consistency and gender variables. On the one hand, as can be seen, there is a big correlation between risk consistency and ambiguity consistency variables, with a p-value of 0.001. On the other hand, if the gender variable is contemplated, the correlation test shows a greater correlation between ambiguity consistency and gender (0.020) than with risk consistency subjects (0.096). These results are coherent with the results discussed above through the p-values obtained in the test of proportions.

Table 2: Spearman’s Rank Correlation between gender, risk and ambiguity consistency

	Risk consistency	Ambiguity consistency	Gender
Risk consistency	-		
Ambiguity consistency	0.001	-	
Gender	0.096	0.020	-

After studying the subject's consistency attitudes towards risk and ambiguity conditions, it has been observed gender differences under both conditions, with a tendency of women to be more inconsistent than men are. Furthermore, compared with attitudes towards risk, gender differences under ambiguity condition are even higher than under the differences in risk condition.

Laying aside the gender differences in consistency, it is going to make a differentiation in gender towards risk attitudes (classified as aversion, neutrality and loving). It is important to emphasize that the majority of the subjects have been classified as risk averse with a percentage of 65.71%, while the subjects classified as risk neutral and risk loving represent a 28.57% and 5.71% respectively. Exploring Figure 4, it can be seen the differences between attitudes in males and females under risk condition. The gap among risk averse and risk neutral subjects is higher in women than in men.

Figure 4: Percentage of risk attitudes by gender

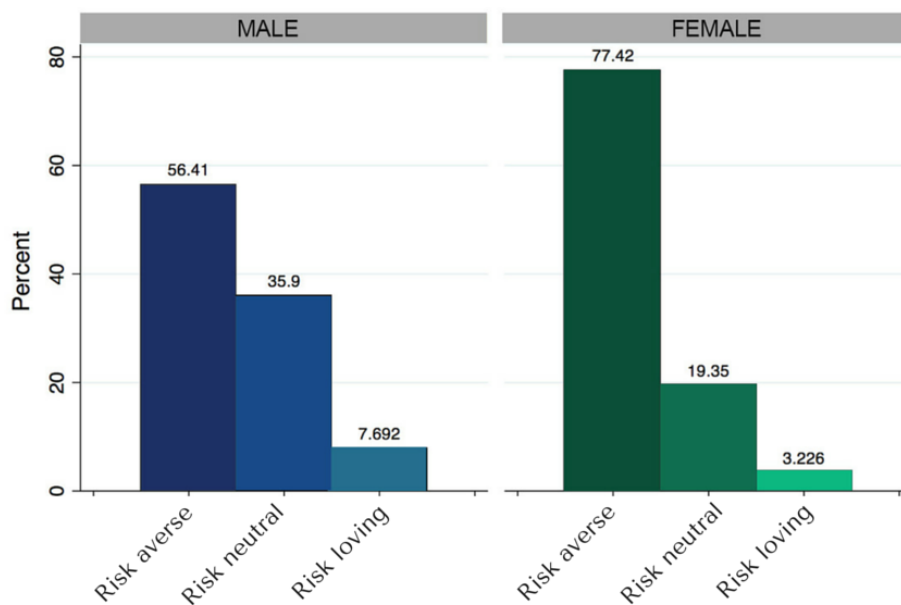


Table 3 precisely shows the results from the proportional test executed in order to measure the existence of gender differences between risk averse, risk neutral and risk loving subjects. With a significant at 5% level and a p-value of 0.034, it is possible to reject the null hypothesis that claims the absence of gender differences and to support the alternative hypothesis which says that women tend to be more risk averse than men do. Continuing with the comparison of gender differences within risk attitudes, it can be seen a similar conclusion with risk neutral subjects. Gender differences are also present in risk neutral attitudes being marginally significant at 10% level with a p-value

of 0.066. Regarding to subjects classified as risk loving, significant differences between males and females are not found. Due to a low level of percentages in both genders, it is no possible reject the null hypothesis.

Table 3: Proportion test for risk attitudes

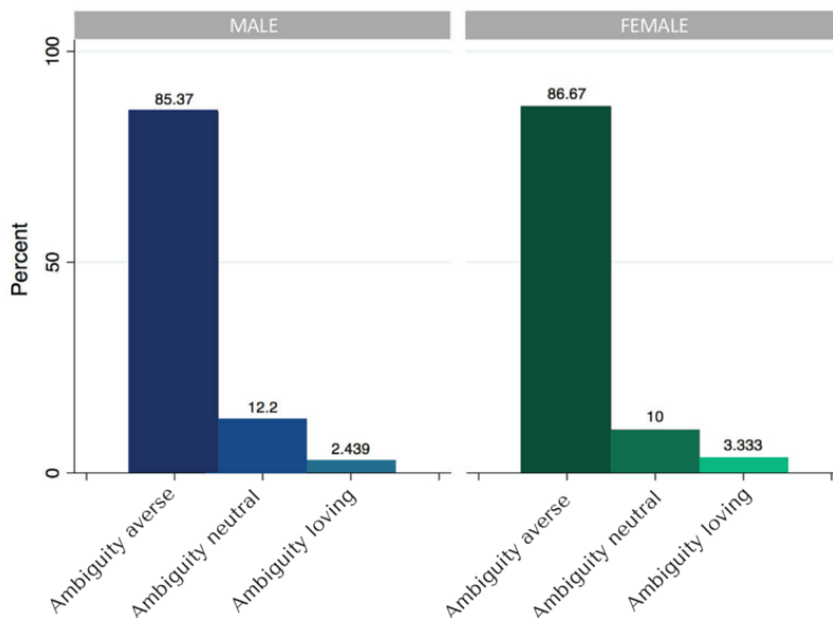
	Risk averse	Risk neutral	Risk loving
Ho: difference=0	Ha: diff < 0 p- value: 0.034**	Ha: diff > 0 p-value: 0.066*	Ha: diff > 0 p-value: 0.216

* significant at 10% level

**significant at 5% level

Concerning ambiguity consistency and without considering the subject's gender variable, the vast majority of the subjects presents ambiguity aversion attitudes, as the percentage of 85.91% shows. The ambiguity neutral behaviour presents an 11.26% of the subjects and finally, ambiguity loving attitudes hardly presents a small proportion of the subjects classified with a 2.81%. Observing Figure 5 and analysing attitudes towards risk, it is can be observed that the percentage of ambiguity aversion is higher than the percentage of subjects classified as risk averse. Consequentially the ambiguity neutrality and ambiguity loving classification play a smaller role than in attitudes towards risk.

Figure 5: Percentage of ambiguity attitudes by gender



Keeping in mind the gender differences displayed in Figure 5, it is easy to observe that the difference between the percentages of the ambiguity neutral and ambiguity loving

attitudes in males and females are imperceptible. Table 4 shows summarized the results obtained in the proportional tests realised for each attitude. It can be observed that in none of the three attitudes analysed – aversion, neutrality and ambiguity loving - is possible to reject the null hypothesis in favour of the existence of gender differences between males and females. The p-values showed in Table 4 are not high enough to affirm the existence of gender differences. Concluding, ambiguity condition only presents significant gender differences in ambiguity consistency classification but it does not exist relevant differences in the distinct classifications used under ambiguity condition.

Table 4: Proportional test for ambiguity attitudes

	Ambiguity averse	Ambiguity neutral	Ambiguity loving
Ho= difference = 0	Ha: diff >0 p- value: 0.561	Ha: diff > 0 p-value: 0.388	Ha: diff > 0 p-value: 0.588

Following the same line and working with the analysis results. A similar correlation test has been conducted to those already commented about consistency. The results reached are displayed in the following tables.

Firstly, data sets about risk aversion, ambiguity aversion and gender variables are shown in Table 5. The highest level of correlation is presented between risk aversion and gender variables (0.038). In contrast, the comparisons between risk aversion and ambiguity aversion variables and, ambiguity aversion and gender variables do not show any type of correlation between them. The fact that the ambiguity aversion and gender variables are not correlated is not surprising, due to the fact that in the attitudes towards ambiguity no one has presented relation with gender variable in the proportion tests earlier obtained.

Table 5: Spearman’s Rank Correlation between gender, risk and ambiguity aversion

	Risk averse	Ambiguity averse	Gender
Risk averse	-		
Ambiguity averse	0.935	-	
Gender	0.038	0.771	-

Secondly, Table 6 and Table 7 expose a similar analysis to the one displayed in Table 4, but considering neutrality and loving attitudes respectively. Table 6 shows a similar

result than the one obtained in the aversion variable. There is only one marginally correlation between risk neutral and gender variables (0.066). Otherwise, the possible existence of correlation between ambiguity neutral behaviour and gender, and between risk and ambiguity neutral behaviour is eliminated, what means that a subject classified as risk neutral does not have to be neutral in front of ambiguity.

Finally, Table 7 shows risk loving, ambiguity loving and gender variables correlations test. Under this behaviour, there is not existence of correlation between them.

Table 6: Spearman’s Rank Correlation between gender, risk and ambiguity neutrality

	Risk neutral	Ambiguity neutral	Gender
Risk neutral	-		
Ambiguity neutral	0.936	-	
Gender	0.066	0.872	-

Table 7: Spearman’s Rank Correlation between gender, risk and ambiguity loving

	Risk loving	Ambiguity loving	Gender
Risk loving	-		
Ambiguity loving	0.693	-	
Gender	0.534	0.774	-

Summarising, the Spearman’s Rank Correlation test used to compare the gender variable with each attitude – as well risk attitudes as ambiguity attitudes- shows the same results as the proportional test executed. Comparing the correlations between each pair of attitudes –risk consistency versus ambiguity consistency; risk aversion versus ambiguity aversion; risk neutrality versus ambiguity neutrality; and risk loving versus ambiguity loving – a paradoxical fact can be observed: correlation is existent between risk consistent and ambiguity consistent subjects. Better explained it says that, if a subject is classified as risk consistent is quite possible that the same subject has been classify as ambiguity consistent. Nevertheless, there is no correlation among the other attitudes analysed what supposes that a subject classified as risk averse does not have to be automatically classify as ambiguity averse.

Finally, it has been estimated a different logit models, where the dependent variables are aversion, neutrality and loving for both risk and ambiguity attitudes. The explanatory variables used for each regression are, on the one hand a dummy variable (Female) which takes value equal to 1 if the subject is a female and 0 if the subject is a male, and on the other hand a variable which measure risk or ambiguity attitudes, taking value 1 the aversion behaviour, value 2 the neutrality behaviour and value 3 loving behaviour.

In Table 8 is displayed the regressions effectuated which dependent variables are the three attitudes towards risk analysed before. For instance, in the first column exhibits the regression using risk aversion attitude as the dependable variable. It is possible to confirm- with significance at 5% level - that is more probable that a subject classified as a risk averse is a female than a male.

Analysing the logistic regression data with risk neutrality as dependent variable, it can be concluded with a significance at 10% level that the probability of a subject to be classified as risk neutral and being female at the same time presents generally a lower probability than being a male.

Under these regressions, it is possible to observe that the explanatory variable - which measures if women take different decisions than men do – is only significant under the aversion and neutrality attitudes towards risk. Moreover, the variable ambiguity, which measures if each subject is averse, neutral or ambiguity loving, has not been significant in any of the three regressions developed for risk attitudes.

Table 8: Regression model for attitudes toward risk

	Risk averse	Risk neutral	Risk loving
Constant	-0.122 (0.845)	-0.064 (0.939)	-2.597 (1.350) *
Female	1.314 (0.655) **	-1.277 (0.721) *	-0.755 (1.192)
Ambiguity	0.258 (0.656)	-0.424 (0.752)	-0.245 (0.983)
Number of obs	55	55	55
Pseudo R2	0.067	0.062	0.017

Standard error in parenthesis. *significant at 10% level

**5% significant at 5% level.

Continuing with the results obtained through the development of different regression for each attitude and condition, Table 9 exhibits the results about ambiguity attitudes. The findings show that the gender of each subject of the experiment does not have relevant influence over any of the three attitudes towards ambiguity analysed. To summarise, as has already been commented along this section, neither gender or risk environment have significant influence on subject's decisions towards ambiguous scenarios. (remember that under ambiguity condition, the women's decisions are only significantly different in ambiguity consistency classification).

Table 9: Regression model for attitudes toward ambiguity

	Ambiguity averse	Ambiguity neutral	Ambiguity loving
Constant	1.928 (1.056) *	-2.734 (1.174)**	-2.833 (1.029) ***
Female	-0.261 (0.762)	0.297 (0.855)	3.97e-16 (1.455)
Risk	-0.131 (0.591)	0.464 (0.613)	0 (omitted)
Number of obs	55	55	55
Pseudo R2	0.003	0.014	0.0000

Standard error in parenthesis. *significant at 10% level **significant at 5% level.
 *** significant at 1% level.

The analysis conducted across the present section shows a clear result: women's choices are significantly different of those done by men in risk and ambiguity consistency who exhibited a higher level of consistency rather than women. In the same way, it can be seen gender differences in risk aversion and neutrality aversion attitudes.

In spite of that, there is not evidence that women's choices are a significant factor in order to classify each subject as averse, neutral or ambiguity loving. None of the ambiguity or uncertainty attitudes here analysed advertised conclusive results about gender differences.

What refers to the correlation between the different variables, there is significant the correlation between risk consistency, ambiguity consistency and gender. Nonetheless, at the time to classify consistent subjects in the different attitudes (aversion, neutrality

and love) it is possible to find a similar result as introduced by Cohen, Jaffray and Said (1985) and Cohen, Tallon and Vergnaud (2010), who previously introduced that the correlations between risk and ambiguity conditions are null. These results are highly stimulating because risk consistency and ambiguity consistency are correlated and, by contrast, when the consistent subjects are classified by their own attitudes, there are no correlation between the variables.

4. Conclusions

Gender differences, as it has been commented in the first section of the present study, it is a theme in which is possible to find a great quantity of studies and researches. Numerous authors have dedicated its papers to revise the existing literature in this field. On the one hand, Crosson and Gneezy (2009) and Eckel and Grossman (2008) reviewed behaviour's literature towards risk, supporting the result that the vast majority of papers shows a higher risk aversion in females than in males. On the other hand, Etner, Jeleva and Tallon (2012) realize a similar literature's revision with the references about ambiguity attitudes. Their conclusions show a certain grade of uncertainty –in the absence of significant gender differences – about which are the factors that have considerable influence in ambiguity decisions.

In the present study, it has been performed an experiment and subsequent analysis with the aim of finding gender differences in making decisions involving on the one hand the risk condition and, on the other hand the ambiguity condition. Therefore, it has been used a group of 104 subjects formed by males and females in the same proportion. In total, each subject plays 18 different scenarios: 9 of them are about risk attitudes and the other 9 about ambiguity attitudes.

In the previous section, the results obtained have been explained, using different methods such as a proportion test, correlation test and econometric models. The results show significant gender differences in certain attitudes, but not in all of the attitudes defined. Both risk consistency and ambiguity consistency presented significant gender different at 5% level, being more representative in the ambiguity consistency condition.

Similar to the results obtained by Croson and Gneezy (2008), the results presented in this study show significant differences under risk aversion attitudes between men and women. Men are more risk prone and women are more risk averse. Furthermore, risk neutrality has also significant differences between males and females, although gender

differences are only significant at 10% level. Regarding risk loving attitudes, there are not significant differences between both genders, being too low the number of subjects classified as risk loving.

As far as attitudes towards ambiguity – and considering that gender differences in ambiguity consistency have been found – it is not possible to conclude that ambiguity aversion, neutrality ambiguity and ambiguity loving present any gender differences between men and women. These results are in line with those obtained by Viscusi and Chesson (1999), who confirm that in low ambiguity scenarios there are not found significant gender differences.

Logistic models complement the previous results obtained. The regressions show if the decisions took by women are considerable different from the decision made by men for each attitude. The regressions demonstrate that only risk and neutrality aversion presents significantly different attitudes between men and women. Additionally, ambiguity, neutrality and ambiguity loving as in risk loving, the logistic model used here do not find any significant difference in women's decisions.

The most interesting result discussed in this section is the fact that, even though a subject classified as risk consistent is highly likely that the same subject would be classified as ambiguity consistent. The other different attitudes studied have not correlation between them: on the one hand, a subject classified as risk averse is not necessarily classify as ambiguity averse; on the other hand, though a subject presents risk neutrality attitudes it does not mean that the same subject has to present neutrality attitudes towards ambiguity, and the same happens with the loving attitudes. Some authors, such as Borghans et al (2010) have already obtained similar results in their studies. They explain that risk and ambiguity attitudes depend on different kind of variables. In this context, it is needed to do further research in order to measure with more detail which are the factors that influence the decision making under uncertainty.

The present study exposes an experimental study developed with the participation of 104 students enrolled at Universidad de Valencia. It is possible to affirm that all participants are residents of the same region (city of Valencia and outskirts). Due to this fact, I would suggest for futures researches to develop an experimental study using the same methodology but taking into consideration subjects from different regions. For example, if we have into consideration risk and ambiguity behaviour of the Spanish people, it would be interesting add cities such as Bilbao in the north, or Sevilla in the south of Spain. Hence, it would be possible to compare the existence of differences

between regions. Likewise, it would be possible comparing the difference between countries.

Following a similar logic, the study is conducted with students who in the majority of cases are people dedicated exclusively to their study, being a smaller range of them who combine their studies with a work schedule. Therefore, I would propose to expand the analysis. In this way, it would be possible considering gender differences in risk and ambiguity scenarios with employed and unemployed people.

References

Blau, F.D. and Kahn, L.M. (2000). "Gender Differences in Pay." *Journal of Economic Perspectives*, Vol. 14 (4), pp. 75–99.

Blavatsky, P.R. (2009). "Betting on own knowledge: Experimental test of overconfidence". *Journal of Risk and Uncertainty*, Vol. 38, pp. 39-49.

Borghans, L.; Golsteyn, B.; Heckman, J. and Meijers, H. (2010) "Gender differences in risk aversion and ambiguity aversion". *Journal of the European Economic Association*, Vol. 7 (2-3), pp. 649-658.

Buchan, N. R.; Croson, R. and Solnick, S. (2008). "Trust and Gender: An Examination of Behavior and Beliefs in the Investment Game." *Journal of Economic Behavior and Organization*, Vol. 68 (3–4), pp. 466–76.

Byrnes, J.P.; Miller, D.C. and Schafer, W.D. (1999). "Gender differences in risk taking: a meta-analysis". *Psychological Bulletin*, Vol. 125, pp. 367–383.

Cadsby, C.B. and Maynes, E. (2005). "Gender, risk aversion, and the drawing power of equilibrium in an experimental corporate takeover game". *Journal of Economic Behavior y Organization*, Vol. 56, pp. 36-59.

Cohen, M.; Jaffray, J.Y. and Said, T. (1985) "Individual behavior under risk and under uncertainty: an experimental study". *Theory and Decision*, Vol.18, pp. 203–228.

Cohen, M.; Tallon, J.M. and Vergnaud, J.C. (2010) "An experimental investigation of imprecision attitude and its relation with risk attitude and impatience". *Theory and Decision*, Vol. 71 (1), pp. 81-109.

Comeig, I.; Jaramillo-Gutiérrez, A. and Ramírez, F. (2013) "Do women self-selected as good borrowers?" *Working papers Universitat Jaume I, 2013 / 14*.

Comeig, I; Grau-Grau, A; Jaramillo-Gutiérrez, A; Ramírez, F. (2015). "Gender, self-confidence, sports, and preferences form competition", *Journal of Business Research*, Vol. 69 (4), pp. 1418-1422.

Croson, R. and Gneezy, U. (2009). "Gender differences in preferences". *Journal of Economic Literature*, Vol. 47, pp. 1–27.

Curley, S.P.; Yates, J.F. and Abrams, R.A., (1986). "Psychological sources of ambiguity avoidance". *Organizational Behavior and Human Decision Processes*, Vol. 38, pp.230–256.

Eckel, C. and Grossman, P.J. (2008). "Men, women and risk aversion: Experimental evidence". *Handbook of Experimental Economics Results*, Vol. 1, chapter 113, pp. 1061-1073, Elsevier.

Eckel, C. and Wilson, R. (2004). "Conditional Trust: Sex, Race and Facial Expressions in a Trust Game." Unpublished.

Etner, J.; Jeleva, M. and Tallon, J.M. (2012). "Decision theory under ambiguity". *Journal of Economic Surveys*, Vol. 29 (2), pp. 234–270.

García-Gallego, A.; Georgantzís, N. and Jaramillo-Gutiérrez, A. (2009). "El papel del genero en la toma de decisiones bajo incertidumbre". *Cuadernos económicos del ICE*, Vol. 77, pp. 151-163.

García-Gallego, A.; Georgantzís, N. and Jaramillo-Gutiérrez, A. (2012). "Gender differences in Ultimatum Games: Despite rather than due to risk attitudes". *Journal of Economic Behavior and Organization*, Vol. 83, pp. 42-49.

Gneezy, U.; Niederle, M. and Rustichini, A. (2003). "Performance in Competitive Environments: Gender Differences". *Quarterly Journal of Economics*, Vol. 118 (3), pp. 1049–74.

Harris, C.R.; Jenkins, M. and Glaser, D. (2006). "Gender differences in risk assessment: Why do women take fewer risks than men?" *Judgment and Decision Making*, Vol. 1, pp. 48-63.

Holt, C. A. and Laury, S. K. (2002). "Risk aversion and incentive effects". *American*

economic review, Vol. 92 (5), pp. 1644-1655.

Jianakoplos, N; and Bernasek, A. (1998). "Are women more risk averse?". *Economic Inquiry*, Vol. 36, pp. 620-630.

Keck, S.; Diecidue, E. and Budescu, D. (2014). "Group decisions under ambiguity: Convergence to neutrality". *Journal of Economic Behavior & Organization*, Vol. 103, pp. 60-71.

Meier-Pesti, K. (2005). "Effects of masculinity and feminity on financial risk- taking: Some evidence from an experimental study on gender salience". *XXX conference of the Association of Research in Economic Psychology*.

Muthukrishnan, A.V.; Wathieu, L. and Xu, A.J. (2009). "Ambiguity aversion and preference for established brands". *Management Science*, Vol. 55, pp. 1933–1941.

Niederle, M. and Vesterlund, L. (2007). "Do Women Shy Away from Competition? Do Men Compete Too Much?" *Quarterly Journal of Economics*, Vol. 122 (3), pp. 1067–1101.

Powell, M. and Ansic, D. (1997). "Gender differences in risk behavior in financial decision making: An experimental analysis", *Journal of Economic Psychology*, Vol. 18 (6), pp. 605-628.

Powell, M. and Ansic, D. (1999). "Gender differences in financial decision-making: a new approach for experimental economic analysis". *Economia societa e istituzioni*, Vol. 11(1), pp. 71-90.

Sabater-Grande, G. and Georgantzís, N. (2002). "Accounting for risk aversion in repeated prisoners' dilemma games: An experimental test". *Journal of Economic Behavior and Organization*, Vol. 48, pp. 37-51.

Snijders, C. and Keren, G. (2001). "Do You Trust? Whom Do You Trust? When Do You Trust?" *Advances in Group Processes*, Vol. 18, pp. 129–60.

Viscusi, W. and Chesson, H. (1999) "Hopes and fears: the conflicting effects of risk ambiguity". *Theory and Decision*, Vol. 47, pp. 153–178.

5. Appendix

Instructions.

This task involves two tests. And you will be paid for one randomly chosen. You will receive your earnings information of the Task at the end of the experiment.

In this test you will take part in a series of decisions where you must choose between two situations. These situations are represented by cards and in each of these situations two conditions exist:

- **Condition 1:** All the information is displayed on the screen. Both situations have the same probability to occur, but the amounts of euros you can win are different.
- **Condition 2:** There is missing information on the screen. The amount of euros you can win is the same in both situations, but the probability of occurrence is unknown in one of the situations.

Although you do not display the cards in your computer, they have been previously introduced. It means that, they are real and therefore there is no manipulation at all.

A choice of each condition would be randomly chosen to pay you, what implies, you would be recompensed by 2 of the choices made.

The following templates show an example of decision for each of the conditions that are going to be displayed.

Important: The probability and euros to earn would vary in any decision.

An example is presented below for each condition.

Condition 1.

All the information is displayed on the screen.

The 2 situations have the same probabilities, but the Euros to win are different.

There are 2 decks of cards which contain: 2 blue cards and 8 yellow cards.

On the left side, A, the blue cards are worth 2 euros and the yellow ones 1,6 euros. *On the right side, B*, the blue cards are worth 4 euros and the yellow ones 0,1 euros.

Choose the deck of your preference, A (left) or B (right). Click A or B to indicate your choice.



After making your choice, the computer will randomly draw either a blue card (2 chances out of 10) or yellow (8 chances out of 10).

If you have a question, raise your hand and an experimenter will come to answer you personally. When you are ready, click the Start button.

Condition 2.

The amount of euros you can win is the same in the 2 situations, but the probabilities are unknown in one of the 2 situations. There is missing information.

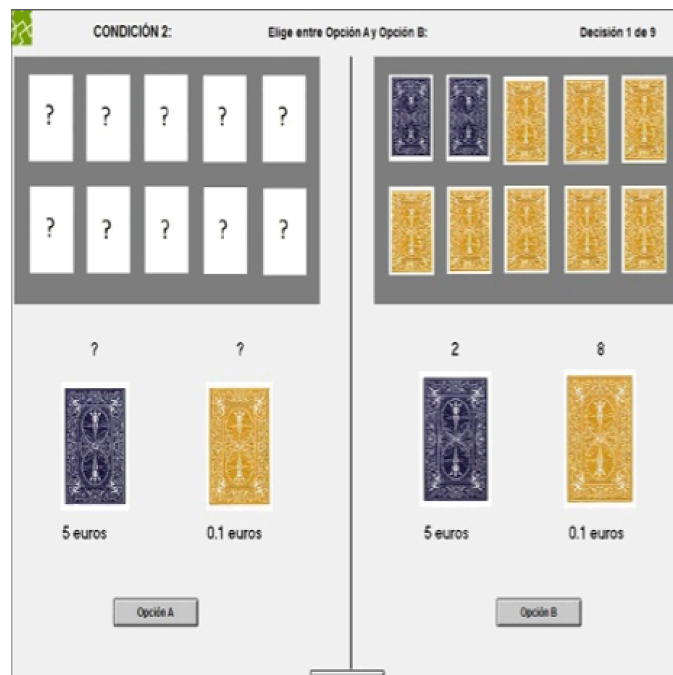
The blue cards are worth 5 euros and the yellow ones 0,1 euros.

On the left side, A, you don't know the number of blue and yellow cards.

On the right side, B, there are 2 blue cards and 8 yellow.

Therefore, on the left side, with probability $1/9$ there will be 1 blue card and 9 yellow; with that same probability ($1/9$) there will be 2 blue cards and 8 yellow cards... and so on up to 9 blue cards and 1 yellow card with that same probability ($1/9$).

Choose the deck of your preference, A (left) or B (right). Click A or B to indicate your choice.



After making your choice, the computer will randomly draw either a blue card (2 chances out of 10 on the left; X chances out of 10 on the right) or yellow (8 chances out of 10 on the left; 10-X chances out of 10 on the right).

If you have a question, raise your hand and an experimenter will come to answer you personally. When you are ready, click the Start button.