Room Composition Effects on Risk Taking by Gender

Marco Castillo*, Greg Leo**, Ragan Petrie*

June 2019

Abstract

We present evidence of a direct social context effect on decision-making under uncertainty: the gender composition of those in the room when making individual risky decisions significantly alters choices even when the actions or presence of others are not payoff relevant. In our environment, decision makers do not know the choices made by others, nor can they be inferred from the experiment. We find that women become more risk taking as the proportion of men in the room increases, but the behavior of men is unaffected by who is present. We discuss some potential mechanisms for this result and conjecture it is driven by women being aware of the social context and imitating the expected behavior of others. Our results imply that the environment in which individual decisions are made can change expressed preferences and that aggregate behavior may be context dependent.

JEL codes: C91, D81, J16

Keywords: gender, decision context effects, risk aversion, experiment

* Department of Economics, Texas A&M University and the Melbourne Institute, Castillo: marco.castillo@tamu.edu, Petrie: rpetrie@tamu.edu

** Department of Economics, Vanderbilt University, gregleo@gmail.com

1 Introduction

Our decisions and behavior can be strongly influenced by who is in our presence. Choices and actions may be different in groups of the same gender than in those of mixed gender. But, can we be influenced by the group gender composition, even if others have no bearing on our choices either now or in the past, and decisions are made in absolute privacy? Understanding whether such effects exist is important because they imply that the mere presence of certain others can affect the choices of individuals. The existence of these effects means that the gender composition of teams or even the design of the built environment, which dictates who one is surrounded by, could impact behavior.

Despite its relevance to understanding decision making, there is no direct evidence showing that who is in the room affects behavior, absent strategic interaction, information transfer, or payoff relevance of others' decisions. We address this by randomly varying the gender composition of the group present when decisions are made in an economic experiment. Importantly, the presence and behavior of those individuals provide no information and are not strategically or payoff relevant.

The results are striking. We find that the gender composition of the room alters individual behavior. Women are more risk taking as the proportion of men in the room increases, whereas men are unaffected. We explore several potential mechanisms for this change and conjecture it is driven by conformity and awareness of social context.

In our research design, individuals are invited to participate in a laboratory experiment on decision making and are randomly assigned to a particular date and time. After all participants arrive, they are randomly assigned to one of two rooms and a seat within the room. Each room is identical with four computers arranged around a table in a way that guarantees privacy of decisions but allows participants to naturally observe the gender composition of the room. At no point is the composition of the room, or gender, explicitly mentioned.

Participants are asked to make a series of eight decisions which consist of dividing \$10 between a certain option and a risky option.[1] The properties of the risky option change over the eight decisions and include lotteries with an expected value less than, equal to, and greater than one dollar per dollar invested. In each session, participants are randomly split into two two rooms to make these decisions.

The composition of the room, in our environment, can affect behavior only through some mechanism unrelated to payoff or behavioral information channels. By randomly assign-

[1]The design is based on Gneezy and Potters (1997). It is a simple design that requires participants to make a choice between how much to invest in a risky and safe lottery (Charness, Gneezy & Imas, 2013).

ing participants to experimental sessions, we minimize selection on unobservables and the chance that participants know one another or would interact with each other afterwards. By randomly assigning participants to one of two rooms, we generate different environments based on gender. By asking participants to perform a task that is individual in nature, we eliminate the effect of payoff dependence. By keeping decisions confidential and randomizing the presentation order of decisions, we make it difficult to infer any information on the decisions of others for a particular lottery. Finally, by randomizing the lottery used to calculate payoffs we reduce any meaningful earnings comparisons across participants, should they engage in such cheap talk after the experiment.

Consistent with previous research (Croson & Gneezy 2009; Eckel & Grossman 2008b), we confirm that women are more risk averse than men. This gives us confidence that our data are not atypical. Room composition has a significant effect on behavior, but it is one-sided. Women become less risk averse in the company of men, but men are unaffected by who is in the room. The effect for women is large – a woman is 3.5 times more likely to invest a dollar in a risky lottery when surrounded by men compared to when she is surrounded by women.

We consider several mechanisms and conjecture that this result is driven by women being more aware of the social context and adjusting their decisions to mimic the expected behavior of those surrounding them.[2] This is consistent with psychology studies which find that women are more likely to conform than men (Bond & Smith, 1996), evidence that individuals guess correctly that women's behavior is more risk averse than men's (Eckel & Grossman 2008a) and social comparison theory (Levinger & Schneider, 1969).

Our paper is not the first to experimentally investigate the role of audience or room composition on individual behavior. However, in other studies, the actions of participants are linked through behavioral, informational, strategic, or other payoff channels. For example, in bargaining, social dilemma or tournament experiments the choices of the other participants are strategically payoff relevant. In dictator experiments, the gender composition of the room may affect expectations about the gender of the recipient and thus be behaviorally relevant.[3]

The literature most closely related to our study examines gender composition of groups and risk attitudes. Adolescent girls are found to be more risk taking when in same-sex groups

[2]Gender differences in development and behavior appear early in life (McClure, 2000; Zahn-Waxler, Shirtcliff, & Marceau, 2008; Baron-Cohen, Knickmeyer, & Belmonte, 2005). One of these differences is that girls are better at reading the social environment than boys.

[3]See Eckel and Grossman (2001) for gender composition in ultimatum games, Gneezy, Niederle, and Rustichini (2003) for tournaments, Bogan, Just, and Dev (2013) for risk decisions of groups, Charness, Rigotti, and Rustichini (2007) for public and private decisions, Lindquist and Soderbergh (2011) for decisions in Jeopardy's daily double, Cooper and Rege (2011) and Rohde and Rohde (2011) for peer effects in risky decisions, and Ambrus, Greiner, and Pathak (2015) for aggregation of individual risk preferences.

(Booth & Nolen, 2012), and women become less risk averse over time in a same-sex class (Booth, Cardona-Sosa, & Nolen 2014).[4] The results of these studies are consistent with research on gender differences in competitive attitudes (Gneezy, et al., 2003; Niederle & Vesterlund, 2007), where women are more likely to compete in same-sex groups, and suggest the importance of audience effects and signaling (Bohnet & Frey, 1999; Charness, et al., 2007; Andreoni & Bernheim, 2009). By contrast, our results show that when competition, strategic interaction, payoff dependence, previous interactions, feedback and audience effects are not possible, women are less risk averse in the presence of *men*, not women.

There are several implications of our results. Peer effects (Bertrand, Luttmer, & Mullainathan, 2000; Duflo & Saez, 2003; Conley & Udry, 2010) may be even more basic and fundamental, apart from those due to payoff relevant information transmission between group members.[5] If this is the case, some choices are a reflective reaction to who is in the room. This highlights the potential importance of the environment in which decisions are made. For example, if a woman makes more risky investments when in the presence of men, the surroundings in which women consider financial or retirement decisions could have an important impact on the ultimate financial health of women and their families. Our results also have organizational implications, since they suggest that aggregating individual preferences to predict group behavior would produce different outcomes than those produced by examining group behavior directly.

Finally, our results show that gender differences in behavior are not immutable. A woman's behavior in male-dominated activities could end up being similar to that of a man's. However, this might not be costless. While the observed behavior of both men and women might be similar, women might enjoy the task less. This would be consistent with women's preferences having a strong effect on job selection even in the absence of any other observable differences (e.g. Dohmen and Falk, 2011; Buser, Neiderle and Oosterbeek, 2014).

The paper is organized as follows. Section 2 describes our experimental design, Section 3 shows results, Section 4 discusses potential explanations for the results, and Section 5 concludes.

[4] In Booth and Nolen (2012), adolescent boys and girls are randomly assigned to sit in 4-person groups in a large auditorium and complete five tasks in total, including a maze tournament with their group prior to choosing in a binary-choice lottery task.

[5] This also speaks to Manski's (2000) point that peer effects are difficult to identify because they are confounded by information and strategy.

2 Experimental Design

The experiment is designed to identify the effect of different gender compositions of rooms on individual decisions over risky investments. The decisions that participants make are uncorrelated and independent to decisions made by others in the room, and this allows us to isolate the effect of room composition on decision-making.

We collect data from three different sites. At the first two sites (Georgia State University and Georgia Institute of Technology), an equal number of men and women (between 8-10 in total) are invited to participate in a randomly-assigned experimental session on a particular date and time. Participants cannot choose a different date or time. Upon arrival at the lab, participants are randomly assigned to one of two isolated rooms with identical setups. One room is called A and the other B. The letter of the room and a seat number is written on an index card. The index cards for the two rooms are shuffled in front of participants, and each participant chooses a face-down card assigning a room and a seat. This procedure produces randomly-determined room compositions and more rooms of mixed gender than rooms with only one gender. Most sessions had two 4-person rooms, and because of no-shows, some had one or two of the rooms with 3 participants.[6]

At the third site (Vanderbilt University), the room assignment procedure differed slightly. We invited an equal number of men and women (10 in total) to assure 8-person sessions and focused data collection on same-sex and unequal mixed-sex rooms. In any session, the two room compositions are either same sex, (4w, 0m) and (0w, 4m), or mixed sex, (3w, 1m) and (1w, 3m). These room compositions are randomly assigned to days and times, and participants are invited to a randomly-assigned session date and time. Again, participants cannot choose another date and time. Upon arrival, participants are randomly assigned to the room compositions for that session.[7]

Apart from these differences in room assignment procedures, the experimental sessions proceeded identically across the three sites. We find no evidence that room composition is correlated with time of day. For our main results, we control for session fixed effects to account for differences in procedures, selection and any time of day effects. Our main results hold if we restrict the sample to only 8-person sessions and if we also include 6- and 7-person sessions as well. Both sets of results are presented in Table 1.

Each room has a table with four laptop computers arranged such that, when seated, each participant's computer screen is not visible to any other participant (see Figure 1 for a picture

[6] At the first two sites, there are 21 8-person sessions and 14 6- and 7-person sessions. From the 8-person sessions, 6 of the 42 rooms are single-sex.

[7] At the third site, there are 12 8-person sessions, with 6 rooms each of (4w, 0m), (3w, 1m), (1w, 3m) and (0w, 4m).

of the room setup). There are no privacy dividers, and all participants can see everyone else in the room during the entire experiment. The room composition is never explicitly mentioned to the participants, but they can naturally see who else is in the room. Each laptop has a computer mouse to facilitate decision making, and there is a bingo cage with numbered balls on the table. Participants enter the room and sit at the seat number listed on their index card. The seat number also serves as the login number. The instructions for the experiment are on the computer screen, and the participants follow along as an experimenter reads the instructions out loud. Participants are not allowed to communicate with one another at any point during the experiment. A copy of the instructions is in the Appendix. Both experimenters were male and were randomly assigned to rooms as well.[8]

Participants make individual decisions over eight separate lotteries. The lotteries we use are similar to those used by Gneezy and Potters (1997) except that half of the investment decisions include the possibility to lose more than the amount invested. This measure of risk preferences is appealing to use because it is based on a simple, intuitive investment decision, rather than a multiple price list of binary lottery choices.

For each lottery, a participant is asked how many dollars out of \$10 he would like to put in a lottery that pays H with 50% probability and L with 50% probability, where H>\$1>L. The participant can allocate any amount from zero to ten dollars, in one dollar increments, in the lottery. Any dollar not allocated to the lottery pays \$1 with certainty. For the eight lotteries, H can take on one of four values, {\$1.50, \$2.00, \$2.50, \$3.00}, and L can take on one of two values, {\$0, -\$0.50}. The eight lotteries are constructed from all possible combinations of H and L. Three of the lotteries have an expected payoff strictly less than \$1, two have an expected payoff equal to \$1 and three are strictly greater than \$1.

Figure 2 shows a picture of the decision screen for a lottery where H=\$1.50 and L=-\$0.50. The participant enters the amount of money he would like to allocate to the lottery in the box on the left side of the screen. On the right side is a table that lists total earnings for all possible amounts of money put in the lottery, conditional on whether the high payoff, H, or low payoff, L, is randomly chosen. The participant enters the amount to put in the lottery and clicks update. The payoffs for that decision are highlighted in the table. The participant is free to change his decision at any time and can easily move between the eight decisions to make changes. The confirm button for each decision must be clicked before all decisions can be submitted.

It is important to note that payoffs in the experiment depend only on the individual's own decisions and chance. The choices of the other participants in the room have no bearing whatsoever on an individual's payoffs. Our setup is different from previous studies that have

[8]We find no evidence that room composition is correlated with either experimenter.

looked at the effect of room composition because in those studies the actions or presence of others had some impact on an individual's payoffs or expectations. Our design, by contrast, allows us to measure the effect of the environment (room composition) on decisions without these type of payoff or expectation confounds.

The eight lotteries are presented in a random order for each participant. Because of this, at any given time during the decision-making phase of the experiment, the individual participants in the room are making different decisions. This is an important element of the experimental design because it ensures that choices across participants for a particular lottery are uncorrelated. This allows us to further isolate environmental effects from choices.

Decisions are made on the computer. When all eight decisions are submitted by everyone in the room, one decision is randomly chosen to be paid by using the bingo cage. Eight balls, numbered 1 to 8, are placed in the bingo cage and mixed up in front of the participants. One ball is drawn from the cage, with the number on the ball corresponding to the decision number to be paid. Because the eight lotteries over which the participants made decisions are presented in a random order for each participant, paying for a particular decision number meant that each participant is ultimately paid for a different lottery.

Once a decision has been chosen to be paid, two more bingo balls are put in the bingo cage, numbered 9 and 10. The bingo cage is mixed up again, and a ball is chosen to determine the amount paid for the decision chosen. Bingo balls with numbers 1-5 paid one amount and balls numbered 6-10 paid another amount. Finally, whether the amount paid for each set of numbers is the larger or smaller amount ($\$H$ or $\$L$) also differs across participants. This means that a draw of ball number 1, for instance, may pay a low return for one participant but a high return for another. All participants know these procedures ahead of time. Our protocol ensures that participants have little to learn from others decisions, attitudes or reactions. Participants make different decisions over the course of the experiment, and in addition, their payments are not correlated in any way.

Total earnings from the experiment include the payoff from the lottery chosen for payment plus a \$6 show-up fee. Participants are paid in cash privately. Because the lotteries include losses, total earnings from the experiment could be as low as \$1. Average earnings were \$17.02 (s.d. \$7.45), and the experiment lasted 30 minutes in total. In the 8-person sessions, across the three sites, there were 264 participants, 33 sessions and 66 rooms (each room had 4 people). The distribution of gender composition of the rooms is: 7 all-women rooms, 13 rooms with one man, 15 of equal number of men and women, 20 rooms with one woman and

11 all-men rooms.[9] Our main results include 8-person sessions and control for session fixed effects. We also present the results when 6-, 7- and 8-person sessions are pooled.

Over half of the participants were male (55.7%). The most common self-classifications for race are White (50.4%), Black (20.4%) and Asian (16.3%) with 12.9% in other classifications.[10] We control for the racial composition of the room in the data analysis and find no significant effect.

3 Results

There are two main results. First, we confirm that men are more risk taking than women. Second, the gender composition of the room affects the risk taking behavior of women but has no effect on men.[11] In particular, women become more risk taking in the company of men.

Our first result is illustrated in Figure 3. The figure shows the average amount of money invested in the lottery by men and women for each of the eight lotteries. The lotteries are ordered from left to right such that the lotteries are increasing in expected value and variance. The first three lotteries on the left have an expected payoff of less than \$1, the middle two have an expected payoff of \$1, and the last three lotteries have an expected payoff greater than \$1.[12] A risk neutral individual should not invest in the first three lotteries, should be indifferent in investing in the middle two and should invest all his \$10 in the last three.

The figure shows that investment in the lottery increases for both men and women as expected payoff goes up. The amount of money invested, however, is always larger for men than women for every lottery, and it is significantly larger in four of the eight lotteries. This result confirms previous research both generally (Croson & Gneezy, 2009) and specifically in tasks similar to the one used here (Charness & Gneezy, 2012). It also gives us confidence that our data are not anomalous.

Our second result is illustrated in Table 1. The table presents regression results of the amount of money invested in the lottery as a function of the gender composition of the

[9]When we combine 6-, 7- and 8-person sessions, there are 356 participants, 47 sessions and 94 rooms (74 4-person rooms and 20 3-person rooms). In these pooled data, the distribution of gender composition of the rooms is: 9 all-women rooms, 24 rooms with one man, 18 of equal number of men and women, 27 rooms with one woman and 16 all-men rooms.

[10]In the pooled 6-, 7- and 8-person sessions, 55.3% are male, 53.1% are White, 18.3% are Black, and 16.6% are Asian.

[11]Manski (1999) would call this a contextual effect (e.g. the propensity of the individual to behave in some way varies with the distribution of background characteristics of the group).

[12]Most participants (93.2%) are consistent, in that the average amount of money invested in lotteries with an expected payoff of \$1 or more is at least as large as for those with an expected payoff of less than \$1. On average, men are more consistent than women: 97% and 88% respectively.

room, dummies for each lottery and session-level fixed effects. Fixed effects at the session level control for any time of day effects and imply that our results compare different randomly determined room compositions in the same time slot on the same day. Panel A presents the results for 8-person sessions only, and Panel B presents the results for the pooled data of 6-, 7- and 8-person sessions. The regressions are run separately for men and women, and gender composition is specified as the proportion of men in the room and ranges from zero to one (e.g. 0, 0.25, 0.33, 0.5, 0.67, 0.75, or 1).[13] Because of repeated observations over the eight lotteries, errors are clustered by participant.

Column 1 in Table 1 reports an ordered logit regression of the lottery bet on the gender composition of the room. The results show that women put significantly more money in the lottery as the proportion of men in the room increases. As an example, looking at the results from the 8-person sessions (Panel A), going from a room of all women to one of being the only woman in the room, the odds of investing an additional $1 in the lottery increases by 3.5, all else constant.[14] Men, however, do not change the amount placed in the lottery as the gender composition of the room changes (column 2). This gender gap in response to the proportion of men in the room is significant.[15] As a robustness check, if we drop the all-female or all-male sessions and rerun the specifications in Columns 1 and 2, the main result still holds. Women invest more in the lottery as the proportion of men in the room increases, men do not, and the gender difference in response is significant.[16] The results for the pooled 6-, 7- and 8-person sessions (Panel B) are larger in magnitude and more statistically significant.

The remaining columns in Table 1 illustrate the effects of room composition on alternative measures of the lottery investment. Columns 3 and 4 report a median regression of the amount invested in the lottery. The results confirm that women invest more in the lottery as the proportion of men in the room increase and men are unaffected. In 8-person sessions,

[13] All results hold if we instead specify gender composition with dummy variables for whether the participant is the minority sex in the room or the room is composed of all the same sex. Women put more money in the lottery when they are the minority sex in the room. Results in Table 1 also hold if lotteries are grouped by expected payoff of $> \$1$, $= \$1$ and $< \$1$ (see online Appendix).

[14] An ordered logit is preferred in this setting because the investment decision may be nonlinear. The return of a dollar invested in the lottery is different across lotteries and the marginal utility of a dollar gained could be decreasing as gains increase (in the case of a risk averse individual). The coefficient associated with the proportion of men in the room is 1.68, the odds conditional on a 0.75 unit increase in this variable is $exp(1.68 * 0.75) \sim 3.5$.

[15] In a pooled regression with a dummy variable for being male and interaction terms with all the independent variables for the specification in Column 1, the coefficient on the interaction term on the proportion of males in the room is -2.34 (p-value of 0.088).

[16] Without the all-female sessions, the coefficient on the proportion of males in the room is 1.65 (p-value=0.071) for women and -0.77 (p-value=0.444) for men. Without the all-male sessions, these are 1.68 (p-value=0.074) and -1.16 (p-value=0.284) respectively. Testing the gender difference in response yields a p-value of 0.087 without the all-female sessions and 0.053 without the all-male sessions.

the median investment by women significantly increases by $3. Columns 5 and 6 report the results of a linear probability regression of a dummy variable that equals one if the participant invested zero dollars in the lottery. Women are significantly less likely to invest nothing in the lottery as the number of men in the room increases, and for men, there is no effect. The final two columns (Columns 7 and 8) report the effects of room composition on going "all in" the lottery (investing all $10). Room composition has no effect for women or men. Taken together, the results from Columns 5-8 suggest that the overall change in behavior of women is primarily due to a decrease in zero-bets as the proportion of men in the room increases. The results for the pooled sessions (Panel B) show similar effects.

To test the robustness and power of our results, we conducted a randomization test for each of the models presented in Table 1. The test randomly re-assigns the room composition to each participant but maintains the structure of the data-generating process by assuring that each participant in a given room has the same randomly re-assigned treatment and rooms of 3 and 4 individuals are assigned a treatment consistent with the number of individuals. This procedure is consistent with Young's (2017) approach to test the significance of experimental results. All our main results hold. The p-values associated with these tests are reported in Table 1 and are similar to or stronger than those of conventional hypothesis tests for each of our regressions.

In sum, our results show that women are affected by who is in their presence when making individual choices over risky investments but men are not. Women become significantly less risk averse as the proportion of men in the room increases.

4 Discussion

In this section, we consider some possible explanations for our main result. Given that our study was not designed to test mechanisms, we discuss which explanations we can reject using auxiliary data from our experiments and conjecture which might be consistent with the results. Supporting evidence in this section is based on 8-person sessions, but similar results hold for the pooled data.

Room composition might prime gender identity. Since gender identity is more likely to be salient when a person is in the minority (McGuire, 1984) and women are generally found to be more risk averse than men (Croson & Gneezy 2009, Eckel & Grossman 2008b), we would expect women to focus more on this aspect of gender identity in groups in which they are in the minority.[17] If risk aversion is seen as an expectation of how women should behave,

[17]Gender stereotypes of risk attitudes have been found to be persistent (see Grossman, 2013; Grossman & Lugovskyy, 2011).

then this mechanism suggests women's behavior would be most risk averse in groups where they are in the minority. As shown in Table 1, this is not the case and thus does not appear to be a plausible explanation.

In general, participants might feel rushed when making decisions because of the observable behavior of others in the room (e.g. time taken to finish the task, number of mouse clicks). We find that those who make their decisions faster also tend to make riskier choices. The correlation between the total time to complete all eight lottery decisions and the average amount invested in the lottery is -0.288 (p-value = 0.000).[18] If women feel rushed to complete the task in the presence of men, they may make riskier decisions than in groups of women.[19] There is some evidence for this.

In Table 2, columns 1 and 2 show OLS regression results of the total time taken to make decisions by men and women on room composition, and Columns 3 and 4 show similar regression results for total number of mouse clicks taken to make all decisions. Neither men nor women are significantly affected by room composition for time to complete decisions, but women have a higher number of mouse clicks as the proportion of men in the room increases. Table 3 (columns 1 and 2) shows that women invest more in rooms where others are making their decisions faster, whereas men are unaffected.[20] This suggests that women are paying attention to the time taken by others, may feel rushed and then make riskier decisions.

Participants might seek to either conform to or imitate the behavior of others in the group. Our findings are consistent with the joint hypothesis that women are aware of the social context, expect men to be less risk averse than women, and attempt to mimic the behavior of others in the room.

Eckel and Grossman (2008b) find that female participants are more risk averse than men and that this is correctly predicted by others. We collected incentivized data on beliefs at our third site (Vanderbilt). Participants were asked their beliefs of the average investment of the others in the room in three of the eight lotteries. They were paid $1 for one randomly chosen belief question if their answer was within $1 of the true average of the investments of others in the room.[21] Consistent with Eckel and Grossman (2008b), in our data both men and women expect the average investment of others to be larger when they are in rooms with more men, however these differences are small and not statistically significant.

[18]The total time to finish the task is the time it takes the participant to complete and submit all eight decisions. The correlation for women is -0.333 (p-value=0.000) and for men is -0.226 (p-value=0.006)

[19]Kocher, Pahlke and Trautmann (2013) find that risk aversion over gains is not affected by being rushed while risk aversion over pure losses actually increases.

[20]There is no significant effect of the number of mouse clicks on the average risky investment. Coefficients on the average number of clicks by others on average risky investment are -0.005 (p-value=0.209) for women and 0.004 (p-value=0.378) for men.

[21]This procedure elicits a participant's belief about the modal $3 interval for the average bet of others.

Table 3, columns 3-6, show that both men's and women's time to complete the task and number of mouse clicks made are positively correlated with the time to finish and the number of mouse clicks made by others in the room. This is consistent with both men and women paying attention to the observable actions of others, however, only women are affected by the composition of the room. Women may internalize the social context and mimic what others around them are likely deciding to do based on their gender. In this way, our results are consistent with the tendency of women to conform more than men as shown in the Asch (1951) line of conformity studies (Cooper 1979; Eagly & Carli, 1981, Bond & Smith, 1996) and social comparison theory (Levinger & Schneider, 1969).

In sum, we conjecture that our main finding, that women become less risk averse as the proportion of men in the room increases, may be driven by women taking into account the social context, feeling rushed and conforming to the expected behavior of others.

5 Conclusion

We examine the influence of social context on individual decision making in the absence of behavioral information feedback, strategic interaction or payoff relevant information. To do this, we randomly assigned experimental participants to sessions and within sessions to two different rooms and asked them to make a series of private lottery decisions involving gains and losses. Participants faced menus that were personalized in terms of the order in which the lotteries were presented, the lottery selected to determine payoffs and the randomizing device used with each individual. That is, experimental participants faced completely individualized decisions with no meaningful way to link their decisions, payoffs and actions to the decisions, payoffs and actions of other participants in the room.

We find that, even under these strict conditions, individual decisions are strongly influenced by the gender composition of the room: women become less risk averse as the proportion of men in the room increases. The effect is large. A woman is 3.5 times more likely to place a dollar in a lottery when surrounded by men compared to when she is surrounded by women.

The results are most consistent with research showing women are more likely to conform than men (Bond & Smith, 1996). We conjecture that the results may be driven by women paying attention to their surroundings and incorporating the social context into their decisions by matching their choices to a common expectation of how men and women decide when making risky investments.

Our experiment shows that the characteristics of those around us have an effect on decisions independent of feedback or payoff-relevant information. Decisions over risky alter-

natives made while surrounded by others are affected by the gender mix in the room even when decisions are individual and uninformative to the decisions of others. The effect is manifested in the decisions of women, not men, and seems to be due to the activation of homegrown expectations and imitation.

The findings depart from previous literature that has found women more risk taking and competitive in same-sex groups and suggest that once other interacting factors have been removed preferences are expressed differently. The results also have implications for the measurement of individual preferences and their aggregation. Depending on the environment in which individual decisions are made, individual and aggregate preferences could differ significantly, even when decisions are private. It also shows that women might adapt more to their environment than men independent of their underlying preferences. The composition of one's peers, co-workers or friends could have a fundamental effect on preferences, apart from payoff-relevant information.

6 References

Ambrus, A., Greiner, B., & Pathak, P. A. (2015). How individual preferences are aggregated in groups: An experimental study. *Journal of public economics*, 129, 1-13.

Andreoni, J., & Bernheim, B. D. (2009). Social image and the 50–50 norm: A theoretical and experimental analysis of audience effects. *Econometrica*, 77(5), 1607-1636.

Asch, S. E., & Guetzkow, H. (1951). Effects of group pressure upon the modification and distortion of judgments. *Groups, leadership, and men*, 222-236.

Baron-Cohen, S., Knickmeyer, R. C., & Belmonte, M. K. (2005). Sex differences in the brain: implications for explaining autism. *Science*, 310(5749), 819-823.

Bertrand, M., Luttmer, E. F., & Mullainathan, S. (2000). Network effects and welfare cultures. *The quarterly journal of economics*, 115(3), 1019-1055.

Bogan, V., Just, R. D., & Dev, C. S. (2013). Team gender diversity and investment decision-making behavior. *Review of behavioral finance*, 5(2), 134-152.

Bohnet, I., & Frey, B. S. (1999). Social distance and other-regarding behavior in dictator games: Comment. *American economic review*, 89(1), 335-339.

Bond, R., & Smith, P. B. (1996). Culture and conformity: A meta-analysis of studies using Asch's (1952b, 1956) line judgment task. *Psychological bulletin*, 119(1), 111.

Booth, A., Cardona-Sosa, L., & Nolen, P. (2014). Gender differences in risk aversion: do single-sex environments affect their development?. *Journal of economic behavior & organization*, 99, 126-154.

Booth, A. L., & Nolen, P. (2012). Gender differences in risk behaviour: Does nurture matter?. *The economic journal*, 122(558), F56-F78.

Buser, T., Niederle, M., & Oosterbeek, H. (2014). Gender, competitiveness, and career choices. *The quarterly journal of economics*, 129(3), 1409-1447.

Charness, G., & Gneezy, U. (2012). Strong evidence for gender differences in risk taking. *Journal of economic behavior organization*, 83(1), 50-58.

Charness, G., Gneezy, U., & Imas, A. (2013). Experimental methods: Eliciting risk preferences. *Journal of economic behavior & organization*, 87, 43-51.

Charness, G., Rigotti, L., & Rustichini, A. (2007). Individual behavior and group membership. *American economic review*, 97(4), 1340-1352.

Conley, T. G., & Udry, C. R. (2010). Learning about a new technology: Pineapple in Ghana. *American economic review*, 100(1), 35-69.

Cooper, H. M. (1979). Statistically combining independent studies: A meta-analysis of sex differences in conformity research. *Journal of personality and social psychology*, 37(1), 131.

Cooper, D. J., & Rege, M. (2011). Misery loves company: Social regret and social interaction effects in choices under risk and uncertainty. *Games and economic behavior*, 73(1), 91-110.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of economic literature*, 47(2), 448-74.

Dohmen, T., & Falk, A. (2011). Performance pay and multidimensional sorting: Productivity, preferences, and gender. *American economic review*, 101(2), 556-90.

Duflo, E., & Saez, E. (2003). The role of information and social interactions in retirement plan decisions: Evidence from a randomized experiment. *The Quarterly journal of economics*, 118(3), 815-842.

Eagly, A. H., & Carli, L. L. (1981). Sex of researchers and sex-typed communications as determinants of sex differences in influenceability: a meta-analysis of social influence studies. *Psychological bulletin*, 90(1), 1-20.

Eckel, C. C., & Grossman, P. J. (2001). Chivalry and solidarity in ultimatum games. *Economic inquiry*, 39(2), 171-188.

Eckel, C. C., & Grossman, P. J. (2008a). Forecasting risk attitudes: An experimental study using actual and forecast gamble choices. *Journal of economic behavior & organization*, 68(1), 1-17.

Eckel, C. C., & Grossman, P. J. (2008b). Men, women and risk aversion: Experimental evidence. *Handbook of experimental economics results*, 1, 1061-1073.

Gneezy, U., Niederle, M., & Rustichini, A. (2003). Performance in competitive environments: Gender differences. *The quarterly journal of economics*, 118(3), 1049-1074.

Gneezy, U., & Potters, J. (1997). An experiment on risk taking and evaluation periods. *The quarterly journal of economics*, 112(2), 631-645.

Grossman, P. J. (2013). Holding fast: the persistence and dominance of gender stereotypes. *Economic inquiry*, 51(1), 747-763.

Grossman, P. J., & Lugovskyy, O. (2011). An experimental test of the persistence of gender-based stereotypes. *Economic inquiry*, 49(2), 598-611.

Kocher, M. G., Pahlke, J., & Trautmann, S. T. (2013). Tempus fugit: time pressure in risky decisions. *Management science*, 59(10), 2380-2391.

Levinger, G., & Schneider, D. J. (1969). Test of the "risk is a value" hypothesis. *Journal of personality and social psychology*, 11(2), 165.

Lindquist, G. S., & Säve-Söderbergh, J. (2011). "Girls will be girls", especially among boys: risk-taking in the "daily double" on Jeopardy. *Economics letters*, 112(2), 158-160.

Manski, C. F. (1999). *Identification problems in the social sciences*. Harvard University Press.

Manski, C. F. (2000). Economic analysis of social interactions. *Journal of economic perspectives*, 14(3), 115-136.

McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological bulletin*, 126(3), 424.

McGuire, W. J. (1984). Search for the self: Going beyond self-esteem and the reactive self. *Personality and the prediction of behavior*, 73, 120.

Niederle, M., & Vesterlund, L. (2007). Do women shy away from competition? Do men compete too much?. *The quarterly journal of economics*, 122(3), 1067-1101.

Rohde, I. M., & Rohde, K. I. (2011). Risk attitudes in a social context. *Journal of risk and uncertainty*, 43(3), 205-225.

Young, A. (2017). *Channeling fisher: Randomization tests and the statistical insignificance of seemingly significant experimental results.* (London School of Economics Working Paper).

Zahn-Waxler, C., Shirtcliff, E. A., & Marceau, K. (2008). Disorders of childhood and adolescence: Gender and psychopathology. *Annual review of clinical psychology.*, 4, 275-303.

7 Figures and Tables

Figure 1: Room Setup for Experiment

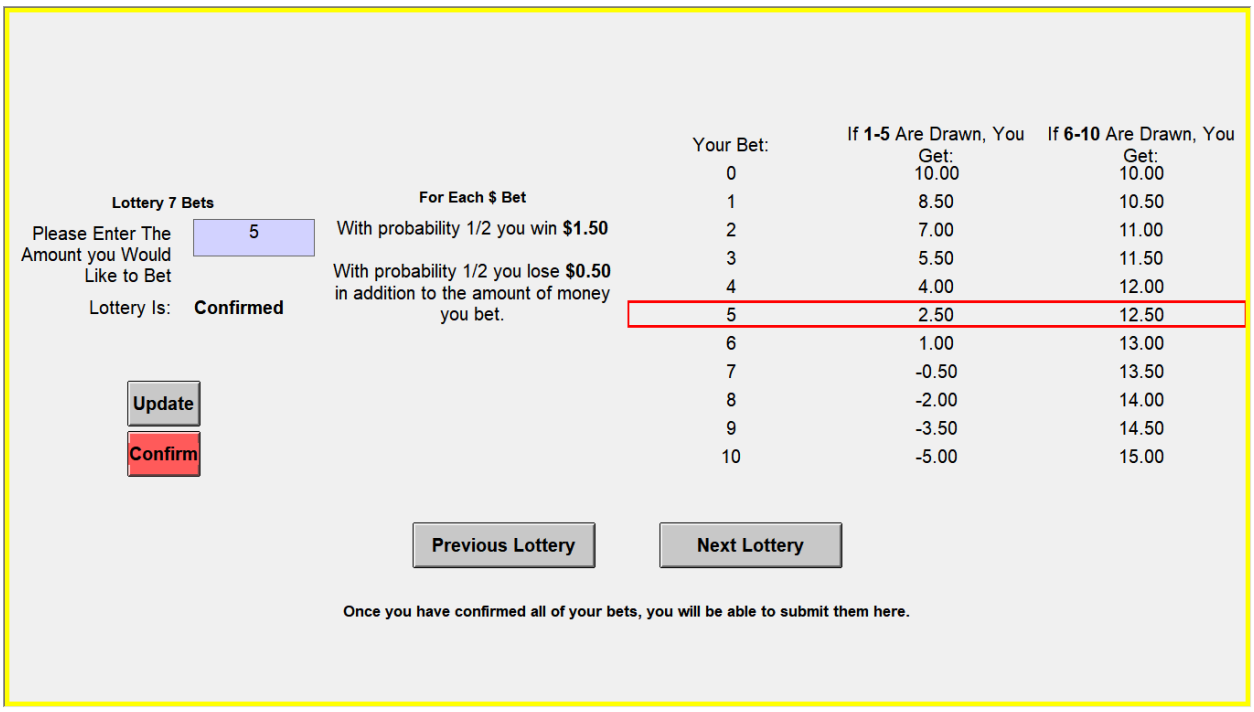


Figure 2: Example Decision Screen for payoffs of $1.50 or -$0.50

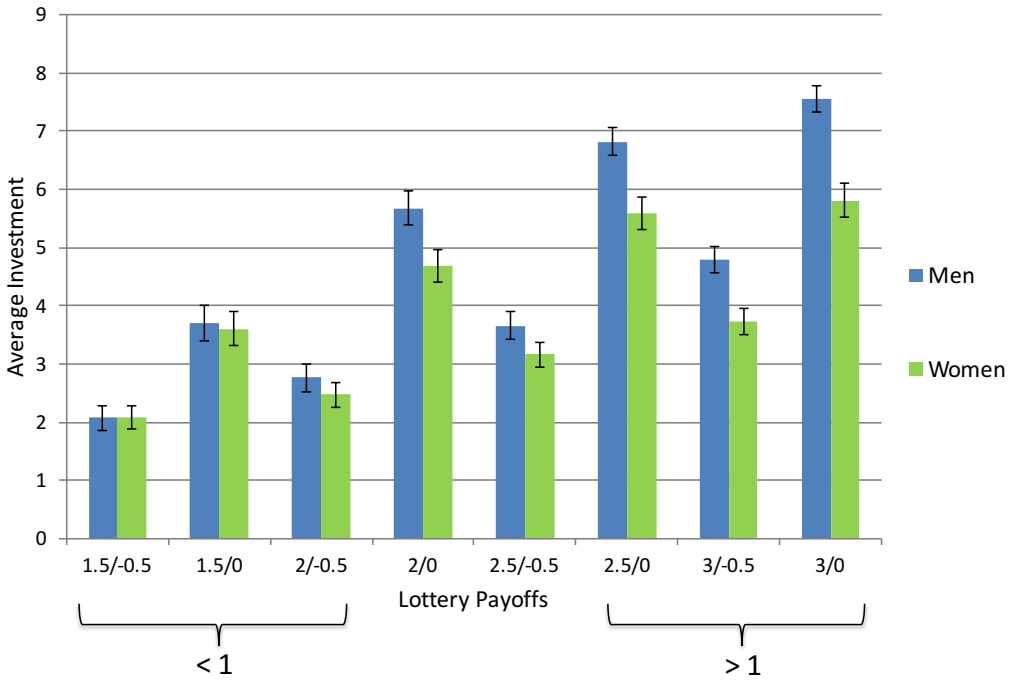


Figure 3: Average Investment by Lottery and Gender (error bars are standard errors of the mean)

Table 1: Lottery Investment by Room Composition and Gender

	(1) Ordered Logit Invest	(2) Ordered Logit Invest	(3) Quantile Reg Invest	(4) Quantile Reg Invest	(5) OLS Zero Invest	(6) OLS Zero Invest	(7) OLS Ten Invest	(8) OLS Ten Invest
VARIABLES	Women	Men	Women	Men	Women	Men	Women	Men
PANEL A: 8-person sessions								
Proportion of males	1.68*	-0.77	3.00*	-1.50	-0.43***	0.20	-0.05	-0.08
	(0.94)	(1.00)	(1.79)	(2.21)	(0.14)	(0.16)	(0.13)	(0.17)
Randomization test p-value	0.032	0.313	0.044	0.318	0.003	0.127	0.623	0.457
Observations	936	1,176	936	1,176	936	1,176	936	1,176
Num of participants	117	147	117	147	117	147	117	147
Session FE	YES	YES	YES	YES	YES	YES	YES	YES
Lottery FE	YES	YES	YES	YES	YES	YES	YES	YES
R-squared			0.28	0.35	0.21	0.26	0.15	0.25
Log likelihood	-1968	-2264	.	.	-319.6	-465.2	9.156	-388.3
PANEL B: 6-, 7- and 8-person sessions								
Proportion of males	2.13**	-0.14	3.75**	-0.00	-0.53***	0.00	0.05	-0.07
	(0.94)	(0.77)	(1.70)	(2.80)	(0.13)	(0.14)	(0.13)	(0.13)
Randomization test p-value	0.000	0.766	0.000	1.000	0.000	0.981	0.422	0.529
Observations	1,272	1,576	1,272	1,576	1,272	1,576	1,272	1,576
Num of participants	159	197	159	197	159	197	159	197
Session FE	YES	YES	YES	YES	YES	YES	YES	YES
Lottery FE	YES	YES	YES	YES	YES	YES	YES	YES
R-squared			0.26	0.35	0.20	0.25	0.15	0.25
Log likelihood	-2670	-3036	.	.	-455.8	-614.7	28.35	-530.6

All regressions in Panels A and B include standard errors clustered by participant as well as session-level fixed effects, a dummy for each lottery choice, proportion of nonwhites in the room and a dummy for nonwhite. Panel B regressions also include a dummy variable for 3-person rooms. *** p<0.01, ** p<0.05, * p<0.10.

Table 2: Ordinary Least Squares Regressions of Time Taken to Submit Decisions and Number of Clicks Made by Room Composition and Gender (8-person sessions)

VARIABLES	(1) Time to Submit Women	(2) Time to Submit Men	(3) Num of Clicks Women	(4) Num of Clicks Men
Proportion of males	43.73	-44.33	45.36***	-18.95
	(50.09)	(41.80)	(17.01)	(22.12)
Constant	315.62***	332.80***	107.90***	147.72***
	(21.32)	(31.99)	(7.24)	(16.93)
Observations	117	147	117	147
R-squared	0.01	0.01	0.06	0.01

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Table 3: Ordinary Least Squares Regressions of Average Investment, Time Taken to Submit Decisions and Number of Clicks by Behavior of Others in Room and Gender (8-person sessions)

VARIABLES	(1) Avg Investment Women	(2) Avg Investment Men	(3) Time to Submit Women	(4) Time to Submit Men	(5) Num of Clicks Women	(6) Num of Clicks Men
Avg time taken	-0.006***	0.002	0.440***	0.629***		
by others	(0.00)	(0.00)	(0.13)	(0.09)		
Avg number clicks					0.423***	0.683***
by others					(0.10)	(0.12)
Constant	5.731***	4.064***	190.938***	104.809***	70.095***	43.775***
	(0.62)	(0.63)	(43.35)	(30.01)	(12.84)	(16.15)
Observations	117	147	117	147	117	147
R-squared	0.08	0.01	0.09	0.24	0.14	0.19

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

8 Appendix

Instructions

Welcome

Welcome to the experiment. This session will last about an hour.

For being willing to participate, you will automatically earn $6. At all times please keep the ID number that you were given at the beginning of the session in a secure place. You will be required to turn this in at the end of the experiment in exchange for your payment.

Anonymity

Your name **will not be revealed** to the supervisor or any other person. At no time, either during or after the experiment, will your name be matched to your decisions or your payment.

This Experiment

In this experiment, you will be deciding how much money you would like to bet on a series of eight lotteries. During the experiment, these lotteries will be displayed on your computer screen in a random order. **For each lottery, you will have $10 to bet.** Of this $10, you must decide how much you would like to wager in the lottery. Once you have finished betting on the lotteries, a lottery will be randomly chosen from the series. This lottery will be the *paying lottery*. Your final winnings will be determined by combining your show up fee of $6 with any winnings or losses from the *paying lottery*.

Lotteries

Each lottery has two possible outcomes: one is a winning outcome and one is a losing outcome. For each lottery, you have a 50% chance of ending up in a winning outcome and a 50% chance of ending up in a losing outcome. To determine whether you win or lose the *paying lottery*, one lottery ball will be randomly drawn out of 10 from the lottery cage. For some lotteries, balls 1-5 represent the "Winning" balls and for some, balls 6-10 represent the "Winning" balls. After you place your bet, the computer will show you how much you stand to win or lose for each of the possible selected numbers.

Each lottery differs in how much you stand to win in the winning outcome and how much you stand to lose in the losing outcome. In the winning outcome of all the lotteries, you will get back at least two times your bet. In the losing outcome of the lotteries, you will either lose just what you bet or you will lose what you bet plus an additional 50% of your bet which will be subtracted from your remaining money (including, possibly, your

show-up fee). Any money you do not bet in a lottery will automatically be added to your winnings. Keep in mind, you will not know which of the lotteries is the *paying lottery* until after you have placed all your bets, so it is wise to pay careful attention to each one. Below are some examples to get you comfortable with the betting process.

Examples

Example 1:

For Each Dollar Bet:

With Probability 1/2 You Win $2

With Probability 1/2 You Lose $0 in Addition to the Money You Bet

If you were to bet $5 on this lottery:

Winning Outcome: $15.00

Losing Outcome: $5.00

If you were to bet $0 on this lottery:

Winning Outcome: $10.00

Losing Outcome: $10.00

If you were to bet $10 on this lottery:

Winning Outcome: $20.00

Losing Outcome: $0.00

Example 2:

For Each Dollar Bet:

With Probability 1/2 You Win $3

With Probability 1/2 You Lose $0.50 in Addition to the Money You Bet

If you were to bet $5 on this lottery:

Winning Outcome: $20.00

Losing Outcome: $2.50

If you were to bet $0 on this lottery:

Winning Outcome: $10.00

Losing Outcome: $10.00

If you were to bet $10 on this lottery:

Winning Outcome: $30.00

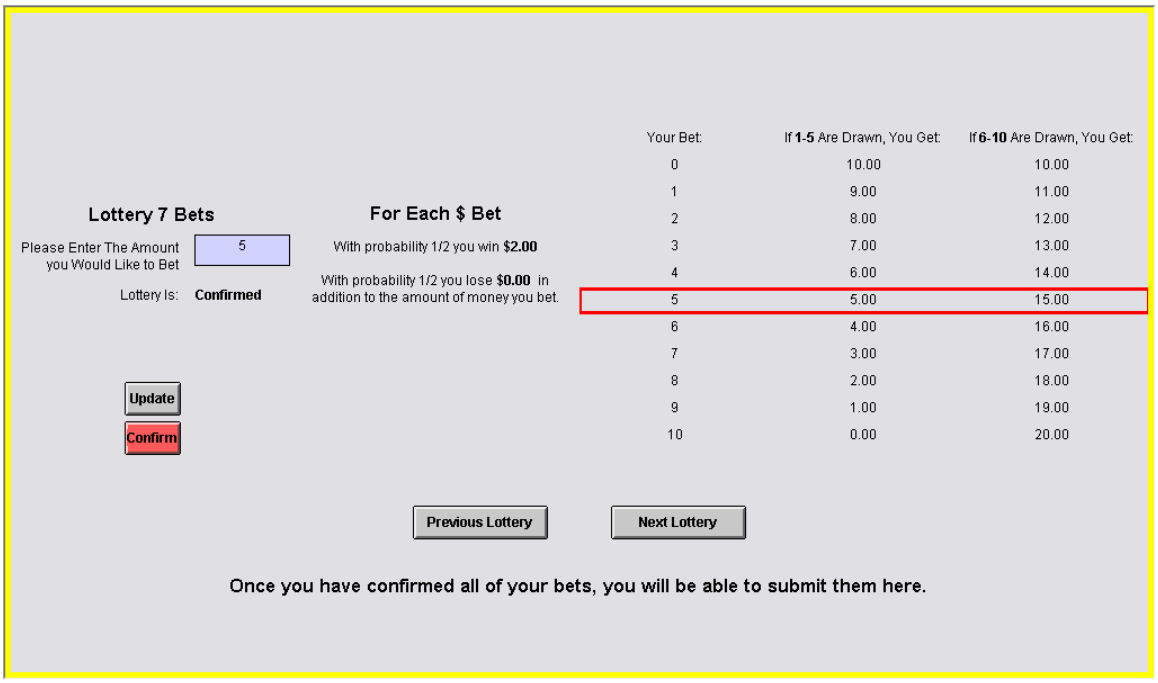
Losing Outcome: -$5.00

Choices and Payoffs

Once the experiment starts, you will see your first lottery on the screen. On the left side of the screen you will be able to enter and confirm your bets. To the right of that, you will see the details of the lottery you are currently betting on. Here, you will see what the lottery pays, per dollar, if you win and how much you will lose, per dollar, if you do not win. On the far right of the screen, your total earnings from each bet are displayed in a grid showing what you will win or lose for each possible ball drawn in the lottery if that lottery is chosen as the *paying lottery*.

Look at the example screen below. In this example, you would be paid $2.00 for each dollar bet in the winning state, and in the losing state, you only lose the amount of money bet. For example, if you bet all $10 in the lottery and if this lottery were to be chosen as the *paying lottery*, you would earn $20 if any ball between 1 and 5 is drawn from the bingo age and $0 if any ball between 6 and 10 is drawn. If you bet $5 in the lottery, you would earn $15 if any ball between 1 and 5 is drawn and $5 if any ball between 6 and 10 is drawn. If you bet no money, any ball drawn between 1 and 10 pays you $10.

Look at the screen below. When you enter your bet and click the "Update" button, a box will appear around your chosen bet. You are free to change your bet at any time. You can confirm your bet by clicking the "Confirm" button. When you do so, the box around your confirmed bet will change to red and the lottery will now be confirmed.



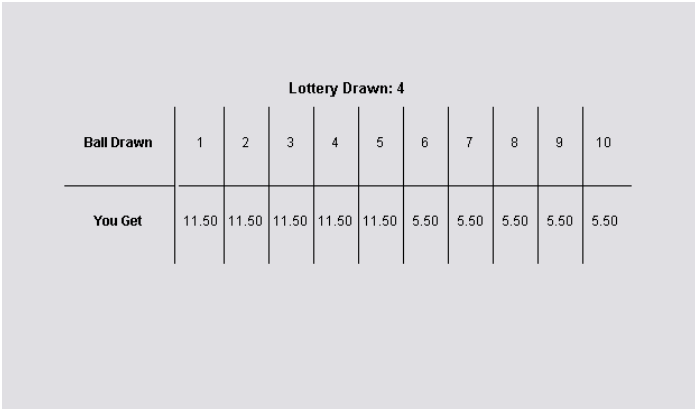
Look at the screen below. In this screen, below the lottery, you can see a button: "Next Lottery". There is also another button, "Previous Lottery" that will appear in all lotteries past the first. These buttons can be used to flip through the lotteries. Feel free to go back

and forth between lotteries as much as you like. You can change your bet on any lottery at any time by entering a new number and clicking update.

Once you have confirmed all of the lotteries, a new button will appear at the bottom allowing you to submit your bets. When you are happy with all of your bets, click this button to lock in your decisions. No changes after this point are possible, so please make sure you are happy with your bets before submitting.

Lottery Selection and Payment

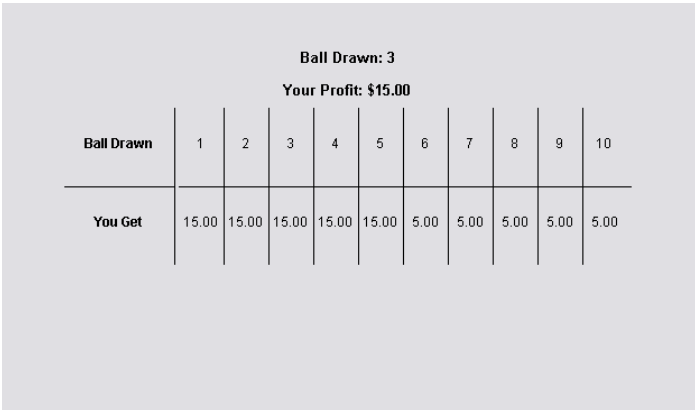
After everyone in the room has submitted their decisions, we will randomly draw a number between 1 and 8 from the bingo cage. The lottery in your series matching the drawn number will become your *paying lottery* and the lottery payment grid for that lottery will appear on your screen as shown below.



Lottery Drawn: 4

Ball Drawn	1	2	3	4	5	6	7	8	9	10
You Get	11.50	11.50	11.50	11.50	11.50	5.50	5.50	5.50	5.50	5.50

After this, ten balls will be placed in the lottery cage. From these, one will be randomly drawn and this will become the winning lottery number. A new screen will appear confirming the winning number and the amount of money you have earned. An example of this screen is shown below.



Ball Drawn: 3

Your Profit: $15.00

Ball Drawn	1	2	3	4	5	6	7	8	9	10
You Get	15.00	15.00	15.00	15.00	15.00	5.00	5.00	5.00	5.00	5.00

Please note that the amount of money shown on this screen is in addition to the $6 show-up fee you earned just for coming to the experiment. There is a possibility of ending up with a negative amount of money from the lottery, in this case, that amount of money will be subtracted from your show-up fee.

Once the lottery is done, another supervisor, outside of the room, will prepare your payment envelope. The envelopes will be labeled with your id number only, so please

make sure you have your id number available. Preparing your payments will take about 10 minutes. Once all of the envelopes have been prepared, you can collect your earnings.

Summary

Step 1: You will be shown a series of eight lotteries.

Step 2: You will enter the amount you want to wager in each lottery (Up to $10 for each).

Step 3: You can easily go back and forth between the lotteries and change your bets until you are happy with your bet in each lottery.

Step 4: Once you are happy with all of your bets, you will submit your decisions.

Step 5: One number from 1 to 8 will be randomly drawn from the bingo cage. The number chosen will be the *paying lottery*.

Step 6: One number from 1 to 10 will be randomly drawn from the bingo cage as the winning number and you will be paid the amount that corresponds to that number in your *paying lottery.*

Step 7: Everyone will receive cash payments in private envelopes at the end of the experiment.