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Social Exchange and Risk and Ambiguity Preferences *

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Résumé / *Abstract*

Nous présentons une expérience en laboratoire dans laquelle nous testons l'effet de participer à un exercice d'échange social sur l'aversion au risque et à l'ambiguïté. Dans notre expérience, les participants jouent à une loterie où ils révèlent leurs préférences face au risque et à l'ambiguïté. Ils participent ensuite à une discussion de groupe déstructurée dans une salle de causette. Après la discussion, les participants peuvent reconsidérer leurs choix dans les instruments de risque et d'ambiguïté. Cependant, dans une session contrôle, d'autres participants observent, sans y participer, une discussion d'une session antérieure. Une analyse de contenu nous informe sur le rôle du contenu de la discussion et de la participation elle-même sur le changement des préférences révélées. Nous comparons nos résultats aux hypothèses de « Discovered Preferences » (Plott, 1996) et de « Fact-Free Learning » (Aragones, Gilboa, Postlewaite, and Schmeidler, 2005).

Mots clés : Instruments de mesure de la préférence vis-à-vis le risque et l'ambiguïté, économie expérimentale, développement économique, développement participatif, apprentissage social.

We present an experiment in which we test for the effect of participating in a social exchange exercise on revealed risk and ambiguity preferences. In our experiments, subjects make choices over lotteries that reveal their risk and ambiguity preferences. They then participate with a small group in an unstructured on-line chat. After the chat, they reconsider their choices in the risk and ambiguity instruments. In a control session, different subjects view, but do not participate in, past chats. Through a content analysis we investigate the role of chat content and chat participation on changes in revealed preferences. We compare our results to the "Discovered Preferences Hypothesis" (Plott, 1996) and "Fact-Free Learning" (Aragones, Gilboa, Postlewaite, and Schmeidler, 2005).

Keywords: *Risk and ambiguity preference measurement instruments, experimental economics, development economics, participatory development; social learning.*

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1 Introduction

Social learning is roughly described as the process through which people learn about an object of decision making from observing the decisions and experiences of others (Munshi, 2008). For example, one of the original and most important field applications of social learning in economics is in the area of technology choice or technology diffusion (Foster and Rosenzweig, 1995; Munshi, 2004; Bandiera and Rasul, 2006; and Conley and Udry, 2010). In a typical theoretical model of social learning, agents observe decisions of other agents before making a decision themselves (e.g., Banerjee, 1992). While there have been many field applications of social learning theory, from Manski (1993) we know that the reflection effect makes it difficult to identify social effects in the field.

Not all learning is through observed actions; one can also learn from advice (Ballinger, Palumbo, and Wilcox, 2003; Celen, Kariv, and Schotter, 2011). Advice is not even always necessary: simply the accumulation and organization of existing information can be sufficient to provide the structure necessary for proper decision-making (Aragones, Gilboa, Postlewaite, and Schmeidler, 2005). The idea is that through some kind of exchange, possibly social, certain regularities become salient, making accessible logic or deduction that was previously dormant within the decision maker.

Not all learning involves simply collecting and assimilating information necessary to make a decision consistent with preferences and appropriate expectations: it is possible, in some domains, that people have to discover their preferences first (Plott, 1996). The discovered preference hypothesis assumes that when people encounter a new environment, it is unclear to them what is in their best interest. But with repetition and feedback their best interest becomes clearer. Stage one involves decision-making in the absence of experience, with decision making that does not appear rational. Stage two includes repetition, experience, and feedback, and decision making that appears more purposeful and rational. Stage three includes the anticipation of rational behavior of others.

In this paper we focus on the social exchange portion of social learning, while abstracting from learning from anyone else's experience. We present an experiment designed to shed light on the effect of the exchange of information on an interesting economics decision making problem. We will examine mechanisms through which effects are transmitted through the lenses of fact-free learning of Aragones, Gilboa, Postlewaite, and Schmeidler (2005), and the discovered preferences hypothesis of Plott (1996). In fact-free learning, people become aware of regularities by being reminded of information already available to them, which makes them able to make decisions consistent with their preferences. With discovered preferences, people use experience and information to determine their preferences in unfamiliar situations.

This paper is an experimental study of how social exchange can affect decisions. In our experiments, subjects make choices that reveal both their risk and ambiguity preferences. They then participate in a small group in an on-line internet-based chat discussion. The discussion is unstructured, and lasts about fifteen minutes. Upon completion of the chat, subjects are invited to reconsider their risk and ambiguity decisions. In a control session, separate subjects viewed, but did not participate in, a past chat.

The ambiguous gambles in our ambiguity instrument are in fact compound gambles that reduce to the simple gambles that comprise the risk instrument. This extra degree of complication in the ambiguous gambles makes it possible for social exchange to bring information to bear on the decision-making problem that would cause subjects to realize this, and influence their decision.

Our experiment makes observable the content of information transmitted during an exercise in unstructured social exchange. With our design we are able to correlate changes in decisions with the content of the chats. Furthermore, through the control, in which subjects only view the information, we will be able to quantify the separate effects of the information and participation.

A content analysis identifies expressions of preferences and transmissions of existing information already provided in the instructions, as well as misinformation, questions, and answers in the chat transcripts. We use this information for evidence of learning mechanisms such as fact-free learning and discovered preferences. The content analysis allows us to control for specific content as we test for the effect of participation in the chat.

Our results show that the act of participation, controlling for chat content, reduces revealed risk aversion. We find evidence of no such an effect for ambiguity choices. We find evidence that expressions of preferences help to explain preference changes, while discussion of known information does not. We conclude that social exchange is more likely to be affecting preferences than to be bringing clarity to the decision-making problem for the expression of well-defined preferences. That is, we find no evidence that additional provision of information, that would allow subjects to make this inference, affects decision making. Instead it is the straightforward revealed risk preference (and consequently ambiguity preference as well) that changes, indicating an outcome closer to the discovered preference hypothesis than fact-free learning.

Our results can shed some light on the the role that participation is increasingly playing in policy making. In international development, for instance, participatory or community-based (community-driven) development is increasingly being considered the preferred approach in large part because it is thought to build on and enhance social capital (Labonne and Chase, 2010). The evidence is mixed as to whether the effects are unambiguously present, partly because of the problems in measuring and identifying social capital and partly because of the potentially negative impacts of elite capture (i.e., the capture of rents from the project by local elites). Our results suggest one possible mechanism through which the role of social capital and participatory development may operate. They suggest that information is more likely to affect decision-making when it is socially exchanged, that is when people have a voice.

The paper continues with the experimental design, followed by experimental procedures.

The presentation of the results and the conclusion follow.

2 Experimental Design

Our experimental design makes observable the content of social exchange regarding a significant and widely used and studied economics decision-making problem. It also makes observable changes in decisions following the social exchange. Finally, it makes possible inference regarding the separate effects of the content of the exchange and simply the participation itself.

The experiment consisted of three stages. In stage one, subjects responded to both risk and ambiguity preference instruments. In stage two, subjects participated in an unstructured on-line internet chat. In stage 3, subjects revised their decisions in stage 1.

2.1 Stage 1

Figure 1 presents the risk instrument, which consists of twelve different binary choices between gambles. Each gamble has two possible outcomes, and each outcome occurs with equal probability. For example, the first row presents a decision between $26 for sure, and a gamble between $24 or $29, each occurring with probability one-half.

As is typical in risk instruments (Eckel and Grossman, 2008; Holt and Laury, 2002), both the expected value and the variance of the right-hand side gambles increase as one goes down the table in such a way that an expected utility maximizer will reveal her risk preference by switching from the left-hand side gamble to the right-hand side gamble at some point in the table. This theoretically makes possible an interval estimate of risk preferences, depending on the location of the switchover point.

Figure 2 presents the ambiguity instrument, which consists of thirteen binary choices between gambles. Each gamble on the left is one of the gambles from the risk instrument.

Choosing a gamble on the left costs $1 to select, i.e., $1 is taken from the subject's earnings if she chooses a left gamble. Each gamble on the right contains the same outcomes as the corresponding gamble on the left, however, the probabilities of the outcomes are not known to the subjects. The left gamble costs nothing to select. The format of the choices is as originally posed in the Ellsberg Paradox (Ellsberg, 1961).

The ambiguity instrument is complementary to the risk instrument: once the subject reveals her risk preference with her switchover point in the risk instrument, the relative location of the same switch-over point in the ambiguity instrument reveals her ambiguity preferences (Klibanoff, Marinacci, and Mukerjee (2005), for the theory; Engle-Warnick and Laszlo (2006), for an application). Roughly speaking, if her switch-over point in the ambiguity instrument is earlier than it is in the risk instrument, then she is ambiguity averse. This is due to the fact that Klibanoff et al. (2005) model, ambiguity as a function of the expected utility function. Thus to infer ambiguity preferences, we need complementary risk and ambiguity instruments. Note that the expected utility of each gamble in the risk instrument is the following:

$$U(g) = pU(x_l) + (1-p)U(x_h) \tag{1}$$

where g denotes the gamble, the probability p is always 0.5, and x_l and x_h are the low and high outcomes associated with the gamble respectively. Klibanoff et al. (2005) introduce an ambiguity function, which in our framework translates to the following expected utility under ambiguity:

$$V(g) = \sum_{i=0}^{10} V[\frac{10-i}{10}U(x_l) + \frac{i}{10}U(x_h)] \tag{2}$$

where the function $V(.)$ represents ambiguity preferences, and where concavity, convexity and linearity represent ambiguity aversion, preferring, and neutrality respectively. The summation over the probability distribution over distributions of outcomes comes from our experimental design, which induces a uniform distribution over the eleven distributions represented in the summation. Notice that to characterize ambiguity preferences, one must not only know a parameter of the $V(.)$ function, but also the distribution over outcome distributions. Our experimental design induces a uniform distribution over distributions.

Our risk and ambiguity instruments allow us to take a step toward distinguishing between fact-free learning and discovering preferences. Notice that every gamble in the ambiguity instrument is a compound gamble that reduces to a simple gamble in the risk instrument. That is, every ambiguous gamble is a gamble with a uniform distribution over all possible distributions of chips in the bag. It is possible to receive information during the social exchange, free of new facts, that would lead an inexperienced subject to come to this realization. If they were to understand this, it is unlikely that they would pay to avoid the compound gamble (unless they have a preference over compound gambles). On the other hand, if it is a preference that subjects are learning by experiencing the gamble choice, then revealed risk and/or ambiguity preference should change after the chat.

2.2 Stage 2

After completing the risk and ambiguity instruments, subjects participated in an on-line chat. Subjects were told that they would be placed in a chat room with two other subjects to discuss anything they wanted. The only restrictions placed on the chat were that subjects may not identify themselves in any way nor use profanity. The duration of the chats was between ten and fifteen minutes, during which time the subjects typed their comments into a line on the screen and viewed the history of all the chat contents in a scrollable window.

In our control sessions, a different group of subjects observed a previous chat, but did not participate. This control allowed us to measure the responses of subjects who did not have the opportunity to participate, while controlling for precisely the information exchanged. The idea is to measure the effect of participation itself, while controlling for the content.

2.3 Stage 3

Upon completion of the chats, subjects were provided with new copies of the risk and ambiguity instruments and asked to record their final decisions, i.e., the decisions for which they would be paid. They were in possession of their original decisions when making their final decisions. They were handed a different color pen so that they could not manipulate their original decision. Subjects were told that they would be paid for exactly one of their final decisions in stage 3, where each decision was equally likely to be chosen for pay.

3 Experimental Procedures

Subjects completed stage 1, the risk and ambiguity instruments, in a paper and pencil format exactly as shown in Figures 1 and 2. Subjects were read instructions for both instruments, given time to answer questions and then filled out the response sheets individually. Subjects were told that they were to make twelve decisions on the risk instrument, thirteen decisions on the ambiguity instrument, and that they would be paid according to the results of one of those twenty-five decisions.

The risky gambles were implemented when a subject pulled a chip out of a bag that contained five blue and five yellow poker chips. Subjects stated out loud which color represented the better outcome of their gamble before reaching in and pulling out a chip. The ambiguous gambles were implemented identically, with the exception that subjects were not told how many blue or yellow chips were in the bag. We drew from the number of yellow chips for the ambiguous bag from the uniform distribution before the session. Subjects were permitted to see the distribution of chips in the bag after their own result if they so requested.

The chats in stage 2 were implemented with open-source internet-based chat software. The software contained a window at the bottom of the screen where subjects could type in their responses, and a window at the top that contained the history of responses in the chat, with the ability to scroll through the window. We used screen recording software (NAME?) to play back the chats for the subjects in the control session.

Subjects were simply told that they were invited to participate in the chat with two other subjects, randomly chosen in the room. Anything was permissible for discussion except for identity and profanity. They were told that the chats would last approximately fifteen minutes. No suggestion was made to the subjects regarding the subject of the chats. In the control, subjects were told simply that they would view a chat from a previous session in a group with two other subjects.

Upon completion of the chats, an experimenter handed out a second, identical set of decision sheets for the risk and ambiguity instruments, and replaced the subjects' pens with a different color pen. The subjects were instructed to fill out the new sheets any way they wished, with the knowledge that these new sheets would determine their pay.

Upon completion of the third stage, and filling out a brief socio-demographic survey (which was not announced in advance), subjects were paid in cash for their participation. 242 subjects participated in total and earned an average of $40 for their decisions, along with a standard, $10 show-up fee for our off-campus experimental laboratory.

4 Predictions and Tests

Our experimental design allows us to test the role that participation plays in decision-making. We can test the effect that participating in the chat (the treatment) has on revealed risk and ambiguity preferences, relative to simply observing the content of the chat (the control). Since subjects are anonymously and randomly assigned to chat groups, the treatment is to participate in an environment where social exchange of information can occur in the absence of confounding factors that would be observed in the real world. Put differently, if the chat content has an impact on decision-making, the information received is independent of any reputation factors that might exist in non-experimental settings. Furthermore, if being randomly assigned to the recorded, treatment, group has a differential impact on decision-making, one may argue it is the mere fact of participating that is important – perhaps subjects put more effort into the decision-making process if they feel they have a voice.

In this sense, our experimental design may have implications for the participatory or community-based development approach to international development. This increasingly popular approach, an alternative to top-down approaches, considers that one of the benefits of community participation is that it makes use of community-level existing social capital (Mansuri and Rao, 2004; Labonne and Chase, 2010). Nevertheless, the empirical problems in defining, measuring and identifying social capital are pervasive in the real world, and operate in an environment of elite capture (Mansuri and Rao, 2004; Fritzen, 2007; Platteau, 2010; Labonne and Chase, 2009 and 2010). Our experimental design thus sheds some light on whether participation in a group setting increases the role that socially exchanged information plays in decision-making. We thus have a clean test of one of the possible mechanisms with which participatory development interacts with social capital. That mechanism is how information is more likely to affect decision-making if people have a voice in that exchange, which we are able to identify in the the absence of confounding factors such as reputation or elite capture.

Our first conjecture involves participatory learning. i.e., the effect on learning of participation in social exchange:

Conjecture 1: Participation in the chats, controlling for chat content, will have an effect on decision making.

Discovery of preferences should be revealed as a change, or an evolution, of preference. The most direct way to measure this in our experiment is to measure the change in risk preferences before and after the chat. It is true that a change in revealed risk preference can also cause revealed ambiguity preference to change, and that ambiguity preference can change while risk preference does not. However, the risk preference choice is more straightforward than the ambiguity preference choice, which brings us to Conjecture 2.

Conjecture 2: If subjects are discovering their preferences, then revealed preferences will change before and after the chat, and expression of preferences will be correlated with change in preferences.

Fact-free learning would involve an exchange of existing information that leads subjects to a different conclusion. The opportunity for this to occur lies with our ambiguity instrument, where if the subjects come to realize that the ambiguous gambles reduce to the corresponding simple gambles, they should not pay to avoid them. This gives us Conjecture 3.

Conjecture 3: If subjects are experiencing fact-free learning, then their ambiguity choices are will change in the direction of paying fewer times to avoid ambiguity, and the exchange of fact-free information will be correlated with a change in willingness to pay to avoid ambiguity.

5 Data Description

5.1 Sample Characteristics

Characteristics of the sample, taken from our convenience subject pool of mostly university students, are presented in Table 1. From the table, the mean age of our subjects was 26.2; half of our sample was female ; and about 46% of the subjects were employed at the time of the experiment. With regard to schooling, which may have an affect on choices not only with regard to risk and ambiguity preferences, but also with consistency of responses, 29% of the subjects reported having attained graduate school, while 64% had attained undergraduate education. The remaining 7% had not attained a university level education. As an estimate for wealth, we took the dwelling value in the area defined by the postal code's first three characters (the Forward Sortation Area - FSA) from the 2006 Canadian Census. The last row of Table 1 reports that average FSA dwelling value for our sample is just over CDN$191,000. We also provide experience with lab experiments as well as experience with experiments involving lottery choice.

5.2 Choices in the risk and ambiguity instruments

Figure 3 presents the histogram of a simple count of the number of times subjects chose the relatively safe gamble (i.e., the number of safe choices) made by each subject, the simple statistic reported in Holt and Laury (2002). We present this simple count, rather than estimate a utility function parameter, because estimating a parameter would involve thirteen ambiguity parameters for each of the twelve risk parameters, because in the case of ambiguity, our behavioral prediction involves the simple measure rather than the preference itself, and because we are not using results here to make predictions in another game or in a field setting: we are interested in changes in frequencies by experimental treatment. Anderson et al. (2008) present a formal estimation procedure (actually joint with a time preference) for risk preference, and Engle-Warnick and Laszlo (2006) demonstrate the estimation of risk and ambiguity parameters and present an application.

In Figure 3, the horizontal axis represents the number of safe choices, zero through twelve, while vertical axis reports the number of subjects who made each choice. Each choice contains two bars, the first for the choice before the chat, and the second for the choice after the chat. According to Figure 3, the distribution of safe choices in the risk preference instrument is roughly bi-modal, with a mode at zero and another at five or six. The CRRA parameter implied by a switch-over point after six safe gambles is approximately 0.40, which is in line with previous studies.

Figure 4 presents the same histogram for the number of times a subject paid to avoid an ambiguous gamble. Again the result is bimodal, with a mode at zero, and another at eight. On average, subjects who pay to avoid ambiguity at least once appear ambiguity averse, since their ambiguity switch-over point is lower than their risk switch-over point.

The following two figures present distributions of the difference between the number of safe choices and the number of times paid to avoid ambiguity, before and after the chat. Figure 5 displays the degree to which subjects changed their revealed risk preference with social exchange.

In Figure 5, a positive number indicates an increasing aversion to risk after the chat. The results in the figure indicate a slightly stronger effect in the negative direction, with a mode at zero. Figure 6 documents the same statistic for paying to avoid ambiguity. The distribution is qualitatively the similar as for avoiding risk.

Figures 7 and 8 show the differences in the number of back-and-forth switches in the risk and ambiguity instruments. Both figures, though not as pronounced in Figure 8, show an increase in the number of zero and one switches post-chat, meaning that irrational type behavior is reduced post-chat.

5.3 Content Analysis

We trained four expert coders, all graduate students in economics, to perform a content analysis on the chats. The coders identified statements in the chats that were of the following type: (1) transmission of a fact that is not new, i.e., that is deemed part of the experimental instructions, or well-known, (2) expression of a preference, i.e., a statement meant to reveal a preference over the lottery selections, (3) question, (4) answer to a question, (5) incorrect statement, i.e., a statement that is factually incorrect regarding the rules of the experiment or some fact regarding the choice itself, and (6) advice.

Chat discussions were generally quite rich, with a minimum of 24 lines to a maximum of 139 lines. Average number of chat lines was 68. An example of a chat is found in Tables 2 and 3 (one chat presented across the two tables). For the most part, subjects' conversations concerned the task they were asked to complete in stage 1: the risk and ambiguity tasks.

Table 4 presents the intercoder correlations for the group-level total number of chat lines per category, the variables we will use in the empirical analysis that will follow. These correlations are quite high especially for the first three categories (no new information, preference and question), and a little lower for the remaining two categories. Intercoder correlations above 0.8 are considered to be "acceptable in most situations" (Lombard, Snyder-Duch and Campanella Bracken, 2010). All correlations for categories 2 and 3 are all well above 0.8, as are two-thirds of the correlations for category 1. The correlations for categories 4 to 6 are lower, but are still high, statistically significant and in all cases positive. Our empirical analysis will nevertheless consider the average rater as well as each rater separately as a robustness check.

6 Results

6.1 Determinants of pre- and post-chat levels

We begin our subject-level analysis by considering the determinants of the pre- and post-chat levels of our behavioral measures as a descriptive exercise. Specifically, we estimate for each behavioral measure:

$$Y_{igt} = \mathbf{X_i'}\alpha_1 + \epsilon_{igt} \tag{3}$$

where i corresponds to the individual, g to his or her chat group and $t = \{0, 1\}$ where 0 is the pre-chat measure and 1 the post-chat measure. $\mathbf{X_i'}$ is a vector of individual demographic characteristics. We consider four different dependent variables Y corresponding to the four behavioral measures. First we consider the number of safe choices in the risk instrument (a proxy for risk preference). Second we consider the number of time the subject paid to avoid the ambiguity in the ambiguity instrument. Third we consider the first ambiguity decision.

Recall that the first decision in the ambiguity instrument (see figure 2 involves a sure bet: the gamble yields $26 10 out of 10 times. Choosing the left gamble in this decision, that is choosing to pay $1 to play the left gamble, is tantamount to choosing a payoff-dominated gamble. While Engle-Warnick et al. (2009) documents instances in subjects may legitimately prefer payoff-dominated options, it is also possible that such choices indicate some subjects' failure to understand the task they are asked to complete.

Because the first two dependent variables are count variables, we estimate these as poisson models.[1] The third dependent variable is binary, so we estimate the last two regressions as probits (marginal effects are presented). The results are found in Table 5. All regressions results report bootstrapped and clustered standard errors. There are four main regularities to report from Table 5. First, risk and ambiguity pre-chat are correlated negatively with age. Second, women are more risk averse than men, and pay fewer times to avoid ambiguity pre-chat than men. Third, previous experience in lottery experience reduces the pre-chat likelihood of choosing to pay to play the first ambiguity decision. Fourth, most significant results occur in the risk instrument. The average value of a dwelling where the subject lives is significant only for the pre-chat number of safe choices. And employment enters significantly only on one occasion in the entire table. Notice that the effects of controls are not always the same in pre-chat and post-chat. This suggests including these as controls in a difference-in-difference approach, which we now turn to.

6.2 Regression analysis of treatment effects

To evaluate whether the treatment to the chat-group, i.e. participation, has an effect on decision-making, we are interested in taking a difference-in-difference approach. Table 6 provides the mean levels of the 4 different outcome variables pre- and post-chat for the treatment and control groups. Panel A shows the mean number of safe gambles pre- and

[1] Using the poisson model to estimate count variables in lottery choice experiments is no unusual (Tanner et al., 2010; Engle-Warnick et al., 2009; and Baker et al., 2008).

post-chat, along with the difference, for both treatment and control sessions. Panel B shows the pre- and post-chat means of the number of times subjects paid to avoid the ambiguous gamble in the ambiguity instrument for the treatment and control groups: no significant differences exist. Panels C repeats this exercise for the choice in the first ambiguity decision.

The only statistically different mean result is in Panel A for the risk instrument. We find a significant reduction in the number of safe choices in the treatment group only: participation in the chat group seems to have made subjects behave as though they are less risk averse. To understand how the chats influenced decision-making, we move to regression analysis. Specifically, we are interested in understanding whether participation in the chat group explains the difference in subjects' choices. To estimate the (difference-in-difference) average treatment effect, we augment (3) with a binary term for random assignment to the chat treatment (that is participating in the chat rather than viewing the chat), a binary for the post-chat period and the interaction between the two binary terms):

$$Y_{itg} = \beta_0 + \beta_1 P_{itg} + \beta_2 PC_{itg} + \beta_3 (P \times PC)_{itg} + \mathbf{X}'_{\mathbf{ig}} \beta_X + \nu_{itg} \quad (4)$$

where ν_{itg} is the error term and P_{itg} takes the value 1 if the subject was randomly assigned to the on-line chat group and 0 if the subject was randomly assigned to view a previous chat, PC_{itg} takes the value 1 if the observation is from after the chat and 0 if it is from before the chat. The treatment effect is picked up by the coefficient on the interaction term β_3. If the mere act of participating has an effect, then we expect β_3 to be statistically significant. Instead of including fixed effects, which would preclude the inclusion of the chat content variables, we include instead observable time-invariant individual characteristics ($\mathbf{X}_{\mathbf{ig}}$).

The parameter of interest is β_3, the average treatment effect. The treatment here is participating versus not participating in the chat group. However, we are also interested in the mechanisms described above: what is it about the content of the chat which matters? In order to understand the roles of 'fact-free learning' or of 'learning about one's preferences', we include the variables from the content analysis by our raters:

$$Y_{itg} = \gamma_0 + \gamma_1 P_{itg} + \gamma_2 PC_{itg} + \gamma_3 (P \times PC)_{itg} + \sum_{j=1}^{6} \lambda_j CHATCAT^r_{jig} + \mathbf{X'_{ig}} \gamma_X + \nu_{itg} \quad (5)$$

There are 6 content categories so that $CHATCAT_1$ is the chat group total chat content lines about no new information, $CHATCAT_2$ is the chat group total chat content lines about preferences, $CHATCAT_3$ is the chat group total chat content lines which are questions, $CHATCAT_4$ is the chat group total chat content lines which are answers, $CHATCAT_5$ is the chat group total chat content lines providing incorrect statements and $CHATCAT_6$ is the chat group total chat content lines providing advice. These variables are chat group-level variables. We will run regression equation (5) for each different rater separately ($r = \{A, B, C, D\}$) and also for the average rater. All regressions are estimated using bootstrapped session clustered standard errors. Regressions for the number of safe choices and the number of time paid to avoid ambiguity will be estimated with the Poisson model, while the regressions for the choice in the first ambiguity decision will be estimated with the probit model (and marginal effects will be reported).

Tables 7 and 8 present the regression equation (4) in the first column and regression equation (5) in the remaining five columns for each of the four content analyzers and the average.[2] We paired subjects who experienced the same chat information across treatments: that is, for the regressions, we matched the subject who generated content for a chat with the control subject who viewed that same information. Table 7 presents these regressions for the number of safe choices as the dependent variable, Table 8 for the number of times paid to avoid the ambiguous gamble.

Result 1: Chat participation, controlling for content, affects risk preferences.

[2] The results on the treatment effect or chat content categories do not change if we exclude the subject demographic characteristics.

Table 7 presents results from a regression of the number of safe choices in the risk instrument on the participation dummy, a time dummy to indicate post-chat and chat characteristics obtained from the content analysis, and subject specific characteristics. From these results, we see a clear treatment effect: participating in a chat lowers the number of safe choices made in the risk instrument. This is consistent across specifications, whether or not we include chat content characteristics, and for all raters. Thus we have our first evidence of a treatment effect on preferences. The chat content categories are mostly statistically insignificant across columns, and the treatment effect coefficient is robust to the inclusion of the chat categories. With regard to individual characteristics, the patterns from table 5 remain: older subjects are less risk averse, women are more risk averse, as are employed subjects.

Table 8 reports regressions results for equation (4) and (5) for the number of times paid to avoid the ambiguous gamble. The average treatment effect (the coefficient on the interaction term) is statistically insignificant, confirming the descriptive analysis in Table 6. However, some of the chat content variables are now significant: the more the discussion provided answers or advice, the lower the number of times subjects chose to pay to avoid the ambiguous gamble. In addition, subjects who previously participated in a lottery experiment tended to pay to avoid the ambiguous gamble less often that subjects for whom this is the first lottery choice experiment.

Result 2: Chat participation has no effect on number of times paid to avoid ambiguity

We next document some empirical results regarding the irrational behavior of choosing to pay to avoid the ambiguity in the first ambiguity instrument decision. Our experimental design permits us to observe whether and how the social exchange affects this behavior, which is widely observed when these types of instruments are used. Table 9 reports another regression of the first decision in the ambiguity instrument. While the average treatment effect is statistically insignificant, the chat content on information that is not new is statistically significant. The more the chat discussed information that is not new, the more subjects were likely to select the payoff-dominated gamble. Previous experience with lottery choice experiments enters the regression statistically significantly, though only at the 10% level when we include the chat content variables.

7 Conclusions

We presented an experiment in which we made observable social exchange that occurs during an economic decision making problem. Our experiment was designed to shed light on the mechanism through which people learn from others in a social exchange. By contrast with the literature on social learning, we focus on communication, and do not make available the ability to learn from other peoples' experiences. Our experiments permit us to learn whether participation in the exchange is critical by manipulating participation while holding information exchange constant.

We designed an informal test of two different notions of learning: fact-free learning, and discovered preferences. Our design permits us to see our results through the lenses of these two theories because our risk and ambiguity instruments are parallel to each other: if a subject realizes that the ambiguous gamble is a compound gamble that reduces to the corresponding gamble in the risk instrument, we speculate that she will at least be less willing to pay to avoid the ambiguous gamble.

We found that participation in the chat reduced revealed risk aversion, controlling for chat content and individual characteristics. We found no such effect for ambiguity choices. We interpret these findings as evidence for participatory learning, evidence that fails to reject discovered preferences, and evidence that provides no evidence, in this context, for fact-free learning. Our results may have implications for the delivery of community-based and community-driven programs. Specifically, they suggest that participation itself in the project can have an effect on decision-making. One mechanism through which this effect might operate is that the act of participating enables individuals to discover their own preferences.

Our one additional finding, that non-rational switching back-and-forth in the ambiguity instrument, but not the risk instrument, is affected by the chat, gives us an avenue for further study of an important phenomenon in the use of similar risk instruments, both in the lab and widely across the field. Further analysis of the content should lead us to formal hypotheses regarding this irrational behavior, which we will be able to test in the future.

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Table 1: Summary statistics

Variable	Mean	Std. Dev.
Age	26.274	6.470
Gender (Male=1)	0.500	0.501
Employed	0.461	0.500
Highest level of schooling attained: Grad	0.291	0.455
Highest level of schooling attained: Undergraduate	0.643	0.480
Participated in an experiment before	0.817	0.387
Participated in a lottery experiment before	0.352	0.479
Average value of dwelling in Forward Sortation Area (CDN$)	191,119	74,085

N=230

Table 2: Example Chat 1

Chat group	line	time	laboid	comment
1	1	4:40	labo02	hello
1	2	5:24	labo01	hi
1	3	5:34	labo03	Hey everyone
1	4	5:45	labo01	hey
1	5	5:54	labo02	Good morning
1	6	6:25	labo01	what should we talk about?
1	7	6:29	labo02	what are we supposed to talk about?
1	8	6:33	labo02	:)
1	9	6:38	labo01	ha ha
1	10	6:49	labo02	do you like lotteries?
1	11	7:12	labo03	yes I do but I never win
1	12	7:14	labo02	personally I dont like to take risks
1	13	7:17	labo03	and you?
1	14	7:17	labo02	hi hi
1	15	7:28	labo01	Ive never played them much
1	16	7:34	labo01	Not the risk taker either
1	17	7:39	labo02	im really not the gambling type
1	18	7:50	labo02	I prefer social games
1	19	7:58	labo02	like scrabble
1	20	8:07	labo03	I do like to take risks but I always lose
1	21	8:43	labo02	Take the lotteries with the lower risk in this case
1	22	9:10	labo01	i feel like doing that
1	23	9:23	labo01	But for the lotteries at the bottom, I feel like I should take the risk
1	24	9:37	labo02	Oh sure
1	25	9:44	labo03	I think the problem is not lower or high risk but the chances to win one colour or the other
1	26	10:14	labo02	actually, it is more easy to take risk when you dont play something of your own
1	27	10:26	labo01	ha ha yeah
1	28	10:33	labo02	sorry for the error
1	29	10:39	labo02	or mistake?
1	30	10:50	labo02	How do you say that in English?
1	31	11:05	labo02	when you say something the wrong way?
1	32	11:11	labo01	I think you can say both
1	33	11:16	labo03	In my opinion, we should choose any of the two in task 1
1	34	11:27	labo02	ye
1	35	11:47	labo01	what do you mean any of the two?

Table 3: Example Chat 1

Chat group	line	time	laboid	comment
1	36	12:36	labo02	humm in task 1 I prefer the one with the lowest risk at the end
1	37	13:04	labo03	but in task 2, when the difference between amounts increases, I take the left side
1	8	13:27	labo02	ha ha I did exactly the contrary
1	39	13:38	labo03	Any of the two means you can take the left or the right lottery because everytime the chances are 50%
1	40	14:09	labo02	there is so much risk anyway, lets go to the most
1	41	14:15	labo02	and dont pay for it
1	42	14:26	labo01	oh, I feel like I should pick the right one always at the bottom
1	43	14:57	labo01	5 out of 10 is still a big risk
1	44	14:57	labo02	I just prefer the left side at the beginning of the second task.
1	45	14:58	labo01	and yeah, like you said, when the risks are that high
1	46	15:26	labo03	you think so? Why the right side is better at the bottom?
1	47	16:00	labo01	The risks are so high regardless, one or two dollars doesnt matter to me anymore
1	48	16:02	labo02	I prefer it just at task 2
1	49	16:18	labo03	for example the 13 what if the chances of winning 2$ were above 5/10?
1	50	16:58	labo01	yeah i prefer right side at the bottom of task 2
1	51	16:58	labo02	yeah youre right
1	52	17:00	labo03	but it can be more paying to take the 50% risk! Hahahaaaa
1	53	17:03	labo01	but I still feel 5 out of 10 is pretty high
1	54	17:12	labo01	in task 1
1	55	17:12	labo02	yeah, me too
1	56	17:40	labo03	hummm I think all is a matter of chance, we can never know
1	57	17:42	labo01	well, I hope the odds are in my favor
1	58	17:52	labo02	there is a lot of chance or not to be really scientific
1	59	17:52	labo01	yeah honestly its just all chance
1	60	18:25	labo02	oh we really think the better way
1	61	18:43	labo02	will you change your minds on he seconds decision sheets?
1	62	19:08	labo03	I wish I was sensitive to the colour in the bag
1	63	19:12	labo01	be more riskier maybe? Ha ha
1	64	19:16	labo02	oups by the better I mean the same sorry
1	65	19:40	labo02	Ill go for blue
1	66	19:47	labo03	I think I am keeping the same decisions for the 1st
1	67	19:52	labo02	or yellow its like summer color
1	68	20:08	labo03	maybe I will change my choice in the second
1	69	21:03	labo02	good luck
1	70	21:03	labo01	u too

Table 4: Intercoder Correlations

	Rater A	Rater B	Rater C	Rater D
Category 1 - Information that is not new				
Rater A	1			
Rater B	0.8713*	1		
Rater C	0.7091*	0.8279*	1	
Rater D	0.7443*	0.8204*	0.8359*	1
Category 2 - Preferences				
Rater A	1			
Rater B	0.8947*	1		
Rater C	0.8264*	0.9172*	1	
Rater D	0.8919*	0.9469*	0.9361*	1
Category 3 - Question				
Rater A	1			
Rater B	0.9571*	1		
Rater C	0.8620*	0.8549*	1	
Rater D	0.9464*	0.9065*	0.8537*	1
Category 4 - Answer				
Rater A	1			
Rater B	0.7231*	1		
Rater C	0.5490*	0.5439*	1	
Rater D	0.7135*	0.6580*	0.6387*	1
Category 5 - Incorrect Statement				
Rater A	1			
Rater B	0.7231*	1		
Rater C	0.5490*	0.5439*	1	
Rater D	0.7135*	0.6580*	0.6387*	1
Category 6 - Advice				
Rater A	1			
Rater B	0.3835*	1		
Rater C	0.6027*	0.4551*	1	
Rater D	0.5967*	0.5567*	0.7274*	1

Note: *: significant at 1%. N=230.

Table 5: Individual Characteristics and Measures

	# of safe choices†		# times paid†		1^{st} amb. choice: left ‡	
	pre-chat	post-chat	pre-chat	post-chat	pre-chat	post-chat
Age	-0.019**	-0.020*	-0.012**	-0.013	0.005	0.002
	(0.009)	(0.011)	(0.006)	(0.010)	(0.005)	(0.005)
Gender (Male=1)	-0.375***	-0.329***	-0.121*	-0.082	-0.090**	0.002
	(0.086)	(0.080)	(0.064)	(0.076)	(0.038)	(0.077)
Employed	0.149	0.223**	0.012	0.077	0.092	0.106
	(0.107)	(0.104)	(0.082)	(0.077)	(0.070)	(0.058)
Highest ed.: Graduate	0.283	-0.136	0.078	-0.040	0.231	-0.018
	(0.175)	(0.698)	(0.284)	(0.207)	(0.691)	(0.318)
Highest ed.: Undergrad	0.078	-0.351	-0.084	-0.159	0.232	0.006
	(0.200)	(0.689)	(0.262)	(0.163)	(0.420)	(0.316)
Ever particip. in experiments	0.040	-0.009	0.056	0.026	-0.025	0.014
	(0.099)	(0.113)	(0.110)	(0.135)	(0.085)	(0.055)
Ever particip. in lottery experiments	-0.069	0.025	-0.109	-0.087	-0.111**	-0.096
	(0.110)	(0.116)	(0.078)	(0.087)	(0.056)	(0.064)
Log Average value of dwelling in FSA	0.230**	0.079	-0.077	0.104	-0.099	-0.056
	(0.114)	(0.107)	(0.118)	(0.103)	(0.072)	(0.066)
Wald χ^2	55.55***	34.42***	28.92***	12.71	45.01***	11.14
Pseudo R^2	–	–	–	–	0.0633	0.0234

Bootstrapped standard errors clustered by session in parentheses. * significant at 10%;
** significant at 5%; *** significant at 1%. N=230. †: poisson estimates. ‡: probit marginal effects

Table 6: Subject Level Means

	Pre-Chat	Post-Chat	Difference
A - Number of Safe Gambles			
Control	4.4359	4.4872	0.0513
	(0.308)	(0.354)	(0.238)
Treatment	4.5133	3.9734	-0.5398**
	(0.324)	(0.325)	(0.238)
Difference	0.0774	-0.5138	-0.5911*
	(0.447)	(0.481)	(0.336)
B - Paid to avoid ambiguous gamble			
Control	5.6410	5.6325	-0.0085
	(0.343)	(0.371)	(0.279)
Treatment	5.2566	5.1062	-0.1504
	(0.330)	(0.322)	(0.266)
Difference	-0.3844	-0.5263	-0.1419
	(0.477)	(0.493)	(0.386)
C - First decision in ambiguity instrument: left			
Control	0.2478	0.2906	-0.0427
	(0.040)	(0.042)	(0.041)
Treatment	0.2035	0.2212	-0.0177
	(0.038)	(0.039)	(0.036)
Difference	-0.0443	-0.0694	-0.0250
	(0.055)	(0.058)	(0.054)

Notes: ***, **, * significant at 1%, 5% and 10%. N=230

Table 7: Number of Safe Choices (Poisson)

		Rater A	Rater B	Rater C	Rater D	Avg. rater
Participate dummy	0.010	-0.009	-0.017	-0.001	-0.013	-0.019
	(0.108)	(0.120)	(0.121)	(0.123)	(0.123)	(0.124)
Post-chat dummy	0.011	0.011	0.011	0.011	0.011	0.011
	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)
Participate × post-chat	-0.139**	-0.139**	-0.139**	-0.139**	-0.139**	-0.139**
	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)
(Group) info that is not new		0.010	-0.001	0.005	-0.011	-0.006
		(0.011)	(0.015)	(0.010)	(0.013)	(0.015)
(Group) preferences		-0.004	-0.004	0.003	-0.005	-0.005
		(0.008)	(0.009)	(0.008)	(0.005)	(0.007)
(Group) question		0.020	0.021	0.015	0.006	0.017
		(0.013)	(0.015)	(0.013)	(0.013)	(0.015)
(Group) answer		0.001	0.004	0.000	0.021*	0.012
		(0.009)	(0.013)	(0.010)	(0.012)	(0.014)
(Group) incorrect statement		0.032	0.041	-0.003	0.034	0.074
		(0.054)	(0.044)	(0.037)	(0.025)	(0.051)
(Group) advice		-0.045	-0.022	-0.024	-0.043	-0.055**
		(0.038)	(0.026)	(0.016)	(0.042)	(0.027)
Age	-0.020**	-0.022**	-0.020**	-0.020**	-0.023***	-0.022**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Gender (Male=1)	-0.352***	-0.352***	-0.356***	-0.350***	-0.345***	-0.347***
	(0.078)	(0.075)	(0.084)	(0.077)	(0.073)	(0.078)
Employed	0.186*	0.174*	0.198**	0.182*	0.213**	0.203**
	(0.102)	(0.096)	(0.086)	(0.094)	(0.099)	(0.094)
Highest ed.: Graduate	0.072	0.141	0.121	0.100	0.145	0.142
	(0.193)	(0.208)	(0.202)	(0.208)	(0.203)	(0.199)
Highest ed.: undergrad	-0.143	-0.088	-0.095	-0.099	-0.067	-0.061
	(0.195)	(0.197)	(0.195)	(0.196)	(0.199)	(0.197)
Ever particip. in exper.	0.009	0.006	-0.014	0.034	-0.015	-0.014
	(0.101)	(0.115)	(0.115)	(0.111)	(0.113)	(0.113)
Ever particip. in lottery exper.	-0.016	-0.001	0.020	-0.023	0.004	-0.001
	(0.114)	(0.118)	(0.125)	(0.126)	(0.123)	(0.123)
Log avg. FSA dwelling val.	0.152	0.110	0.101	0.135	0.088	0.108
	(0.107)	(0.110)	(0.113)	(0.112)	(0.114)	(0.114)
Constant	0.303	0.563	0.576	0.295	0.835	0.524
	(1.347)	(1.374)	(1.392)	(1.436)	(1.435)	(1.422)
Wald χ^2	74.64***	95.32***	114.03***	69.72***	88.88***	98.06***

Bootstrapped robust standard errors (clustered by session) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. N=460.

Table 8: Number of Times Paid to Avoid Ambiguity (Poisson)

		Rater A	Rater B	Rater C	Rater D	Avg. rater
Participate dummy	-0.067	-0.054	-0.061	-0.069	-0.049	-0.058
	(0.093)	(0.090)	(0.103)	(0.099)	(0.094)	(0.100)
Post-chat dummy	0.002	0.002	0.002	0.002	0.002	0.002
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
Participate × post-chat	0.028	0.028	0.028	0.028	0.028	0.028
	(0.072)	(0.072)	(0.072)	(0.072)	(0.072)	(0.072)
(Group) info that is not new		0.007	0.010	0.014	0.010	0.015
		(0.014)	(0.012)	(0.014)	(0.014)	(0.017)
(Group) preferences		0.013*	0.011	0.009	0.005	0.011
		(0.007)	(0.008)	(0.007)	(0.004)	(0.008)
(Group) question		0.002	0.008	0.007	-0.001	0.016
		(0.014)	(0.014)	(0.011)	(0.012)	(0.015)
(Group) answer		-0.013	-0.015	-0.024**	-0.020	-0.031**
		(0.011)	(0.015)	(0.011)	(0.014)	(0.015)
(Group) incorrect statement		-0.012	0.043	0.018	0.043	0.040
		(0.058)	(0.040)	(0.032)	(0.042)	(0.055)
(Group) advice		-0.063	-0.075**	-0.020	-0.088*	-0.080**
		(0.048)	(0.034)	(0.024)	(0.052)	(0.040)
Age	-0.013*	-0.013	-0.011	-0.012	-0.014	-0.013
	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)
Gender (Male=1)	-0.101	-0.098	-0.108	-0.095	-0.098	-0.096
	(0.065)	(0.066)	(0.070)	(0.063)	(0.062)	(0.063)
Employed	0.047	0.020	0.049	0.053	0.009	0.025
	(0.079)	(0.083)	(0.084)	(0.084)	(0.086)	(0.081)
Highest ed.: Graduate	0.032	0.017	0.001	0.013	0.063	0.020
	(0.233)	(0.247)	(0.255)	(0.259)	(0.237)	(0.263)
Highest ed.: undergrad	-0.113	-0.111	-0.100	-0.098	-0.081	-0.093
	(0.202)	(0.218)	(0.235)	(0.239)	(0.216)	(0.244)
Ever particip. in exper.	0.034	0.085	0.079	0.056	0.085	0.099
	(0.111)	(0.101)	(0.101)	(0.098)	(0.103)	(0.097)
Ever particip. in lottery exper.	-0.088	-0.119*	-0.117	-0.091	-0.126**	-0.122*
	(0.068)	(0.068)	(0.079)	(0.080)	(0.058)	(0.070)
Log avg. FSA dwelling val.	0.008	0.031	0.031	0.062	0.076	0.059
	(0.104)	(0.099)	(0.104)	(0.098)	(0.103)	(0.098)
Constant	2.055	1.828	1.731	1.460	1.386	1.490
	(1.272)	(1.254)	(1.276)	(1.233)	(1.258)	(1.210)
Wald χ^2	34.19***	76.81***	60.55***	49.55***	60.65***	70.09***

Bootstrapped robust standard errors (clustered by session) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. N=460.

Table 9: First Decision in Ambiguity Instrument: Left (Probit Marginal Effects)

		Rater A	Rater B	Rater C	Rater D	Avg. rater
Participate dummy	-0.045	-0.050	-0.055	-0.053	-0.047	-0.053
	(0.056)	(0.057)	(0.056)	(0.064)	(0.062)	(0.061)
Post-chat dummy	0.044	0.043	0.043	0.045	0.044	0.044
	(0.045)	(0.045)	(0.044)	(0.046)	(0.045)	(0.045)
Participate × Post-chat	-0.0234	-0.024	-0.023	-0.024	-0.027	-0.025
	(0.071)	(0.071)	(0.071)	(0.073)	(0.073)	(0.072)
(Group) info that is not new		0.010	0.012*	0.014***	0.002	0.011**
		(0.007)	(0.006)	(0.005)	(0.006)	(0.005)
(Group) preferences		-0.003	-0.005	0.000	-0.006	-0.004
		(0.005)	(0.007)	(0.004)	(0.004)	(0.006)
(Group) question		0.005	0.012	0.010*	0.006	0.013
		(0.007)	(0.010)	(0.006)	(0.008)	(0.010)
(Group) answer		0.000	-0.004	-0.008	-0.002	-0.006
		(0.005)	(0.010)	(0.007)	(0.009)	(0.011)
(Group) incorrect statement		-0.009	0.016	-0.001	0.034	0.029
		(0.034)	(0.029)	(0.024)	(0.022)	(0.036)
(Group) advice		-0.015	-0.024	-0.014	-0.038	-0.034
		(0.025)	(0.020)	(0.015)	(0.023)	(0.026)
Age	0.004	0.004	0.004	0.004	0.003	0.004
	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)
Gender (Male=1)	-0.045	-0.058	-0.061	-0.056	-0.051	-0.059
	(0.054)	(0.059)	(0.057)	(0.062)	(0.058)	(0.057)
Employed	0.100*	0.097	0.104*	0.102*	0.105*	0.102*
	(0.059)	(0.060)	(0.059)	(0.061)	(0.063)	(0.061)
Highest ed.: Graduate	0.084	0.109	0.106	0.120	0.137	0.122
	(0.300)	(0.316)	(0.322)	(0.328)	(0.323)	(0.332)
Highest ed.: undergrad	0.111	0.120	0.116	0.141	0.146	0.135
	(0.249)	(0.250)	(0.251)	(0.246)	(0.240)	(0.251)
Ever particip. in exper.	-0.012	-0.003	0.000	0.005	-0.011	0.001
	(0.055)	(0.057)	(0.061)	(0.059)	(0.057)	(0.061)
Ever particip. in lottery exper.	-0.097**	-0.100*	-0.096*	-0.095*	-0.102	-0.102*
	(0.047)	(0.052)	(0.050)	(0.055)	(0.050)	(0.053)
Log avg. FSA dwelling val.	-0.082	-0.094	-0.096	-0.082	-0.095	-0.091
	(0.065)	(0.066)	(0.065)	(0.067)	(0.062)	(0.064)
Wald χ^2	26.16***	31.70**	39.56**	42.42***	58.35***	41.48***
R^2	0.0393	0.0517	0.0670	0.0690	0.0719	0.0694

Bootstrapped robust standard errors (clustered by session) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. N=460.