The Control Premium: A Preference for Payoff Autonomy*

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Abstract

We document a lower bound for the *control premium*: agents' willingness to pay to control their own payoff. Participants choose between an asset that will pay only if they later answer a particular quiz question correctly and one that pays only if their partner answers a different question correctly. However, they first estimate the likelihood that each asset will pay off. Participants are 20% more likely to choose to control their payoff than a group of payoff-maximizers with accurate beliefs. While some of this deviation is explained by overconfidence, 34% of it can only be explained by the control premium. The average participant expresses a control premium equivalent to 8% to 15% of the expected asset-earnings. Our results show that even agents with accurate beliefs may incur costs to avoid delegating and suggest that to correctly infer beliefs from choices, one should account for the control premium.

Keywords: Delegation, control, desire for control, control premium, overconfidence, principal-agent, experiment

JEL codes: C91,D03,D83

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1 Introduction

Many people prefer to maintain control over the events that affect their lives. Despite a robust psychological literature on the 'Desire for Control', it's economic consequences have been largely overlooked.[1] To the extent that the feeling of control contributes to subjective wellbeing (Benjamin et al. 2011), people will pursue it as an objective and be willing to incur costs to retain it.

Thus, a preference for control can influence economic and managerial decisions, in particular by undermining the willingness to delegate tasks to others. For example, it might lead an investor to avoid relying on a more-skilled financial agent, or an executive to micro-manage her subordinates even if they have more specialized skills. This influence has consequences for our understanding of behavior and welfare, and methodological implications for the inference of beliefs from behavior, as has become common in the study of overconfidence, for example.

In this paper we take a first step at investigating the impact of preferences for control by experimentally measuring the *control premium*: the monetary cost that people are willing to incur in order to retain control over their own payoffs. Participants in our experiment take a 10 question quiz, but first make a series of choices between an asset that will pay $20 only if they later answer a particular quiz question correctly and one that pays the same amount only if their partner ('Match') later answers a different question correctly. Participants retain 'payoff autonomy' by choosing payment contingent on their own correct answer, rather than that of their Match. Crucially, we first elicit participants' beliefs about the likelihood of each asset paying off, which allows us to separate the influence of (overconfident) beliefs from preferences for control, in determining asset choices. We calculate the relative subjective

[1] Burger and Cooper (1979) argue that a preference for control is a stable personality trait. Individuals who rate highly on their "Desirability of Control " scale are characterized by an affinity for leadership roles and a preference for making their own decisions. Conversely, individuals with low desires for control dislike responsibility, even with respect to their own lives, and they prefer others to make decisions for them. The notion of desirability of control continues to be used in investigations of behavioral patterns and psychological treatments. For example, Burger (1992) depicts the desire for control as an important factor within various phenomena such as achievement, psychological adaptation, stress, or health.

expected return of the two assets and thus observe when participants sacrifice expected earnings, according to their own perception, to retain autonomy over their own payoff.

We find evidence of a non-trivial control premium. While expected money-maximizers with accurate beliefs would stake their earnings on their own performance in 50% of their opportunities, our participants choose to do so in 59.9% of their choices. We can attribute only 66% of this deviation to overconfident beliefs and conclude that the remaining 34% is driven by the control premium. At the individual level, over 80% of our participants follow a cutoff strategy, in that they choose payoff autonomy if and only if the expected cost is below a fixed level. Preferences for control are heterogeneous: while the modal cutoff is zero, consistent with no control premium, more than 25% of the participants exhibit a positive control premium and some exhibit an aversion to control. The average cutoff corresponds to a control premium of \$0.62 to \$1.19, which amounts to 8% to 15% of the participants' average earnings from the asset choice. The existence of these cutoffs and the fact that they are frequently non-zero, yet rarely extreme, suggests that the preference for control exerts a consistent, well-behaved, non-trivial influence on delegation decisions.

Participants are likely to have private information about their own knowledge and have less precise beliefs about others' performance than about their own. Thus, ambiguity aversion might sway participants to choose a probabilistically inferior asset that depends upon their own success. Rather than viewing ambiguity aversion as a possible confounding factor, we allow that it may contribute to and partially explain the existence of a control premium.

To help us gauge the extent to which this is true, we vary across three experimental conditions (*Baseline*, *Reduced Ambiguity*, and *Minimal Ambiguity*) the amount of information participants have about their Match and the difficulty of his question, thereby varying the difference in ambiguity inherent in the estimates of the Match's performance and their own. We find little evidence that the control premium decreases with ambiguity, suggesting that the desire for control is distinct from ambiguity aversion.

In Section 2 we describe how we meet the challenge of incentivizing the elicitation of beliefs, the asset choice, and the quiz. The manner in which we do so presents two reasons,

discussed further in Section 4, why our method of measuring the desire for control may understate its impact in the field.

First, we use a crossover or lottery mechanism (Allen 1987, Grether 1992, Karni 2009) to elicit probabilities, which avoids bias due to risk-attitudes, but introduces a possible bias that would lower the measured value of the control premium. While our experiment focuses on a individual's desire to control her own outcomes instead of ceding that control to another person, she may also prefer control of her own outcomes to ceding control to a random process. Such a "self-random" control premium would bias upward the stated beliefs about one's own performance that we elicit and therefore bias downward our estimate of the "self-other" control premium.[2]

Second, when participants make an asset choice, we only show them the probabilities they had previously stated for the relevant quiz questions, not the question itself. This likely elevates the salience of the probability estimates in the decision-making process. A participant with a positive desire for control may be inhibited from expressing it when doing so requires a choice so nakedly inconsistent with money-maximization given the probabilities that stare her in the face.

To test the above assertion, we conducted a fourth experimental condition (*No Probability*) in which participants do not make probability estimates, but simply make their binary asset choice while previewing the two relevant quiz questions. Participants in this condition choose the self-reliant asset significantly more frequently, supporting our suspicion that the explicit probability reminders inhibit the expression of the control premium.

This research contributes to the growing experimental literature on delegation decisions. In contrast to recent studies showing how the use of intermediation to shift blame for a harmful decision can reinforce the agency relationship (Bartling and Fischbacher 2011, Coffman 2011, Grossman and Oexl 2011, Hamman et al. 2010), we highlight a factor that undermines it. Previous studies, such as Falk and Kosfeld (2006) show that the exertion of power

[2] If the "other-random" control premium is larger than the "self-random" control premium, then our results *over*state the "self-other" control premium. We find this unlikely.

over others can adversely affect the principal-agent relationship, but they cannot directly attribute the behavior they observe to a preference for control or autonomy, as we do. While Fehr et al. (2010) and Herz et al. (2011) show that people intrinsically value authority or power over others, our research demonstrates that they also value independent control over their own outcomes in situations lacking any conflict of interest.

Our findings also have important methodological implications pertaining the practice of inferring beliefs from choices, most directly in the study of overconfidence (e.g. Camerer and Lovallo 1999, Svenson 1981).[3] Proper scoring rules, such as the quadratic scoring rule (Selten 1998), are a primary tool used to directly elicit beliefs. They have attractive incentive properties, but they can be difficult to explain to subjects and they are sensitive to risk-aversion (Offerman et al. 2009). To avoid these pitfalls, researchers have broadened the methods they use to elicit confidence levels beyond declarations of confidence and statements of probabilities to include making inferences about or even explicitly calculating probabilistic beliefs from choices (see, for example, Grether 1992, Blavatskyy 2009, Abdellaoui et al. 2005, Hoelzl and Rustichini 2005, Holt and Smith 2009, Ericson 2011, Hao and Houser 2010, Hollard et al. 2010). These methods are simple and insensitive to risk attitude, but they cannot pin down beliefs without assumptions about other factors such as image concern, ambiguity aversion, and a preference for control.

The *control premium* is a preference, distinct from the illusion of control (Langer 1975), which is a miscalibrated or biased belief and a potential source of overconfidence.[4] Research that fails to make this distinction while drawing inferences about beliefs from choices risks confusing preference-driven behavior with overconfidence. Both a preference for control and overconfidence could inhibit a person's willingness to delegate. Because our design specifically controls for beliefs, we can distinguish between the two sources of costly self-reliance.[5]

[3] Despite a lifetime of feedback, many individuals remain overconfident both about their relative performance (Moebius et al. 2007, Eil and Rao 2010) and their absolute performance (Grossman and Owens 2011), distorting behavior (Malmendier and Tate 2005).

[4] A related, but distinct psychological concept is the "locus of control" (Burger 1984, Rotter 1990, Lefcourt 1982, Phares 1976), which measures how much control people feel that they have over their lives.

[5] Closely related to our work is that of Charness and Gneezy (2010), who in part of their study let participants

Our finding of a preference-based control premium calls into question the accuracy of any research that does not take into account preferences that might generate costly self-reliance, such as the desire for control, when inferring beliefs from choice. In Section 4, we provide an example of how to reinterpret the results of a previous study on overconfidence, Hoelzl and Rustichini (2005), accounting for the preference for control. Making this distinction also has welfare implications: while financial losses due to miscalibrated beliefs are easy to interpret as reducing welfare, it is not clear that similar losses due to a preference-driven control premium should be viewed in the same way.

2 Experimental Design

Experimental sessions were conducted at the Experimental Economics Laboratory for Policy and Behavioral Research at the University of Delaware (UD). Participants were recruited from the laboratory's subject pool (largely comprised of UD students). Each session lasted roughly 80 minutes and included between 7 and 13 participants. Each participant earned either \$5 or \$25, including a \$5[6] show-up fee and which was paid privately in cash at the end of the session. Each participant took part in only one session, and hence only one experimental condition. Decisions were entered into the experimental economics software program z-Tree (Fischbacher 2007). Full instructions for all conditions, as well as screenshots are presented in the Appendix.[7]

Upon arriving at the experiment, participants sat at computer terminals, and were randomly assigned to take one of two quizzes, Quiz A or Quiz B. They were anonymously matched with a member of the other group, whom we called the participant's 'Match'.[8] We

choose whether to roll a die used to resolve the uncertain return of an asset or to allow the experimenter to do it. However, without eliciting participants' beliefs about the outcomes of a die rolled by themselves versus the experimenter, one cannot judge whether participants' believed they could influence the outcome more favorably than the experimenter and whether their behavior was consistent with expected-payoff maximization given their beliefs.

[6] In the *Minimal Ambiguity* and *No Probability* conditions, which were more time-consuming, the show-up fee was \$10, so participants earned either \$10 or \$30.

[7] The software is available upon request.

[8] For clarity, we use female pronouns for an arbitrary participant and male pronouns for that participant's Match.

describe all four experimental conditions below. The three principal conditions all shared a basic, four-part protocol, differing mainly in the information available about the Match during the belief-elicitation in Part 1. Participants read instructions for Part 1 and completed Part 1, before reading the instructions for Parts 2 through 4 and completing those parts. Each set of instructions was also read aloud by an experimenter.

Participants were randomly assigned to one of three payment groups, numbered 1–3, each with equal likelihood. Members of group 1 were paid according to the results of Part 1 of the experiment, group 2 was paid according to the results of Part 2, and group 3 was paid according to the results of Part 3. Participants were not told to which group they had been assigned until the end of the experiment. In Part 4, participants completed questionnaires, which did not affect payments in any way.

2.1 Part 1: Quiz Previewing and Belief-Elicitation

In the three *principal conditions*, each participant individually previewed each of the 10 questions from both quizzes, both hers and that of her Match, for 15 seconds each. The quiz consisted of logic and reasoning questions, the majority selected from a book of Mensa quizzes (Grosswirth et al. 1999). After previewing each question, each participant estimated the likelihood that it would be answered correctly, by herself if the question were taken from her own quiz and by her match if the question were taken from the match's quiz, when the quiz was completed in Part 3.

We judged 15 seconds to be enough time to read the question and gauge difficulty, but short enough to render solving the questions unlikely.[9] Participants were reminded that, when it was time to answer the questions, they would have an entire minute to do so. The questions were previewed in the order they appeared on the quizzes, with the exception that the source alternated between the quiz the participant was to take and the quiz that her Match was to take. Figure 1 shows a screenshot of a sample preview screen. Participants

[9] A longer preview period may have lead to extreme estimates for each participant's own questions, reducing the likelihood that the binary choices would feature reasonably similar likelihoods.

were told that they would answer each question in Part 3, but they did not learn about the binary choices of Part 2 until after Part 1 was completed.

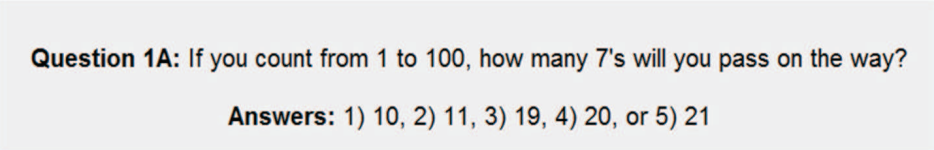


Figure 1: An example of a preview screen

After fifteen seconds, the screen automatically advanced to a belief-elicitation screen. Following a preview of questions from the participant's own quiz, she entered the percent chance with which she believed she would answer that question correctly. We denote the corresponding probability p^s. Figure 2 shows a screenshot of the elicitation.

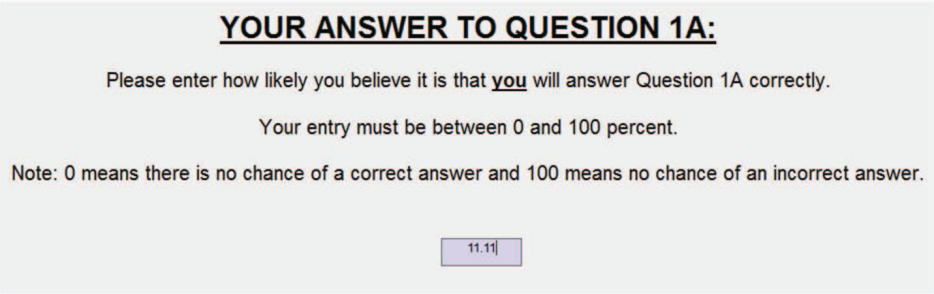


Figure 2: Screenshot of a belief-elicitation screen for a question from the participant's own quiz

For questions from the Match's quiz, the participant entered the percent chance with which she believed her Match would answer the question correctly, with the probability denoted p^m. We varied the information provided on this screen across the three principal conditions, which we ran in separate sessions. In the *Baseline* (BL) condition, the only information participants had to inform p^m was the question itself. In the *Reduced Ambiguity* (RA) condition, the participant was also given her Match's own stated p^s, $p^s(M)$, and an indicator of the Match's confidence in his own ability to answer the question. In the *Minimal Ambiguity* (MA) condition, participants were given *three* pieces of information potentially relevant to the Match's ability to answer the question: 1) as an indicator of the

Match's general quiz-taking ability, his score on a preliminary quiz—taken *before* Part 1 and administered only in this condition—consisting of ten questions from the same source as the main quizzes;[10] 2) as an indicator of the difficulty of the specific question, the percent of participants answering it correctly in previous sessions, and 3) the information provided in the RA condition.

Figure 3 shows an elicitation screen for a question from the match's quiz, for each condition. The computer automatically advanced to the next preview after the participant entered a value. We used a crossover mechanism[11] (Allen 1987, Grether 1992, Karni 2009) to incentivize the statements of p^s and p^m for Part 1 of the experiment.

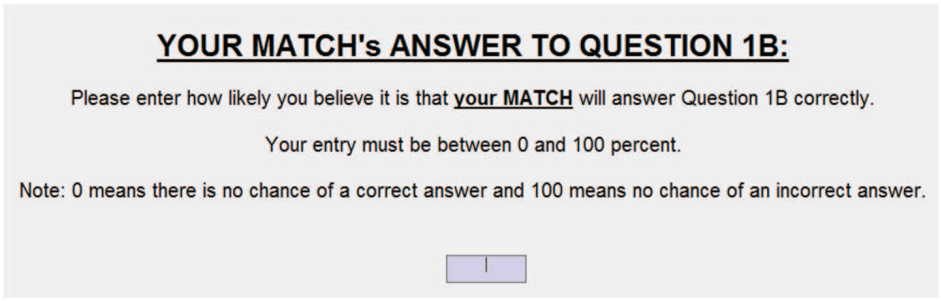
2.2 Part 2: Binary Asset Choices

In Part 2, each participant made ten binary choices between two assets, each of which would pay \$20 contingent on a correct answer to a specified quiz question, one selected from her own quiz (Asset S) and one from her Match's (Asset M) quiz.[12] Only after completing Part 1 did participants read the instructions to Part 2. Thus, they expressed p^s and p^m in Part 1 without the knowledge that the binary asset choices in Part 2 were to come. As shown in Figure 4, each participant was reminded of the probabilities, p^s and p^m, that she herself had previously estimated for each corresponding correct answer. Participants were *not* shown the questions themselves at this point, as this would allow them to re-assess the likelihood of correct answers, possibly rendering the previously stated p^s and p^m inaccurate. Importantly,

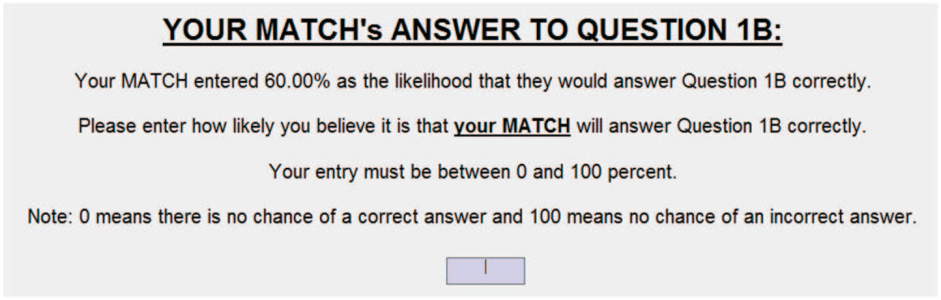
[10] Like in Part 1 of the experiment, participants we given 60 seconds to answer each question. Questions were incentivized via a fourth 'payment group' in the MA condition that paid \$20 if a participant answered a randomly selected question from the preliminary quiz correctly. The complete list of questions can be found in the appendix. In the instructions for the MA condition, the preliminary quiz was referred to as Part 1, and the remaining parts as 2-5. Instructions are available in the Appendix.

[11] One of the twenty previewed questions (ten for the participant herself, and ten for her match) was selected randomly for each member of payment group 1, with each equally likely. We compared the probability estimated by the participant for the selected question to a randomly drawn probability, p. If the belief exceeded the drawn probability, then the participant was paid \$20 if the selected question was answered correctly and \$0 if it was answered incorrectly. Otherwise, the participant was given a lottery that paid \$20 with probability p and \$0 with probability $1 - p$.

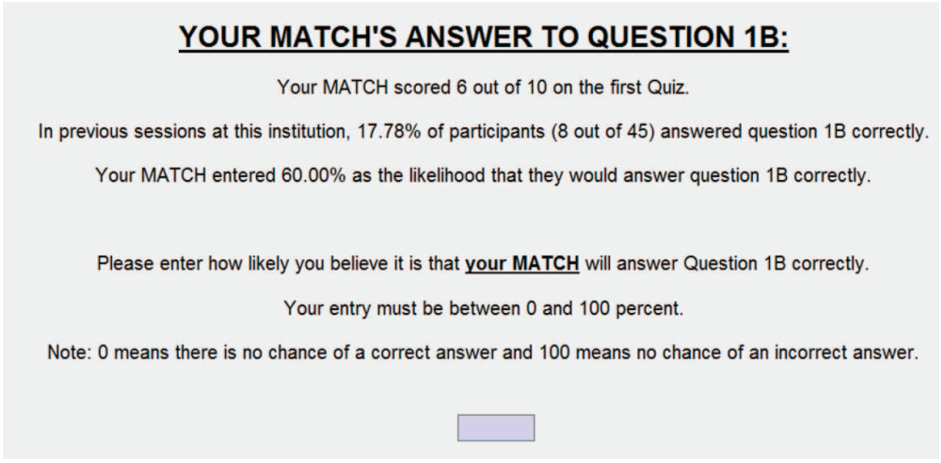
[12] During the experimental sessions, the terms 'Option X' and 'Option Y' were used to refer to 'Asset S' and 'Asset M', respectively, as shown in Figure 4.



(a) *Baseline*



(b) *Reduced Ambiguity*



(c) *Minimal Ambiguity*

Figure 3: Screenshots of the belief elicitation for each condition for a question from the match's quiz

p^s and p^m are the *only* pieces of information that participants had on which to base their choice of assets.

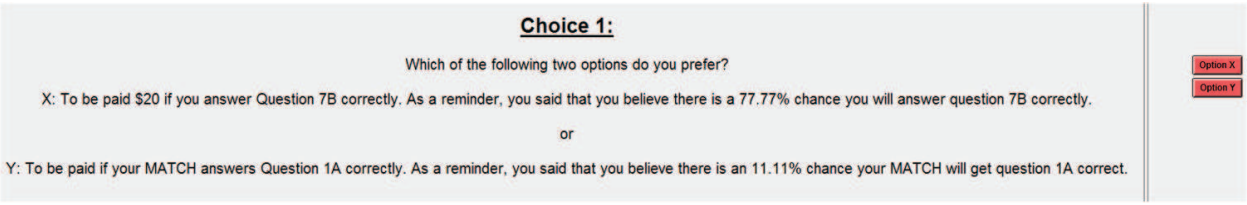


Figure 4: Screen shot of an asset choice

For each of the ten binary choices, the two questions were randomly selected, *with replacement*, with an equal likelihood for each question of each quiz. This selection method yields a variety of parings of p^s and p^m for the binary asset choices, including some in which the estimated probabilities are very different from one another. Note that by fixing the two possible outcomes at \$0 and \$20 and varying only the perceived probability of the higher payoff, the design avoids the complication of risk-attitudes affecting the binary asset choice. One of the ten binary choices was selected for payment for members of payment group 2, each with an equal likelihood.

2.3 Part 3: The Quiz

In Part 3, participants answered the ten questions of their quiz, with 60 seconds allotted for each question. The complete list of questions can be found in the appendix. For payment group 3, one of the ten questions was randomly selected, with each one equally likely, and the participant was paid \$20 if she answered the selected question correctly.

2.4 Part 4: Questionnaires

In Part 4, participants first completed a brief demographic questionnaire, recording age, gender and course of study. Then, they answered the questions of Burger and Cooper (1979)'s Desirability of Control (DC) scale, a questionnaire that measures individual preferences for

control.[13] After Part 4, participants learned the payment group that they were assigned to, were paid anonymously in cash, and departed from the laboratory.

2.5 The *No Probability* Condition

A fourth condition was conducted to test whether the conspicuousness of the probability estimates when participants made their binary choices dampened the expression of the control premium. Participants in the *No Probability* (NP) condition also chose between Assets S and M, but never estimated p^s or p^m. Instead, they were simply shown the question previews and asked to choose, as shown in Figure 5. They were allowed 30 seconds to make their asset choice, matching the combined preview time of the three primary conditions. The twenty-two participants in this condition each answered fifteen questions and made fifteen binary choices, compared to ten each in the other three conditions. Other aspects of the NP condition, including payment[14] and the questionnaire, mimic those in the three principal conditions.

3 Results

We conducted eleven sessions with a total of 108 participants (33 in BL, 27 in RA, 26 in MA, and 22 in NP), yielding a total of 860 quiz answers and 860 binary choices in the three principal conditions (BL, RA and MA) and 330 answers and choices in the NP condition. We discarded forty-seven binary choices in the three principal conditions and 14 in the NP condition, for which we lacked probability estimates or binary choices were not entered in time, leaving 813 choices for our analysis in the three principal conditions, and 316 in the

[13] The DC test has responders report their level of agreement with twenty statements using a seven-point Likert scale, with 1 indicating "strongly disagree" and 7 indicating "strongly agree". The DC Scale examines several facets of control including: the desire to make decisions for oneself, the desire to take leadership roles, the desire to avoid situations where others are in control, and the desire to plan or prepare to maintain control over future situations. The full set of questions used in the scale is available in the Appendix.

[14] There were only two payment groups in the NP condition, analogous to payment groups 2 and 3 in the principal conditions.

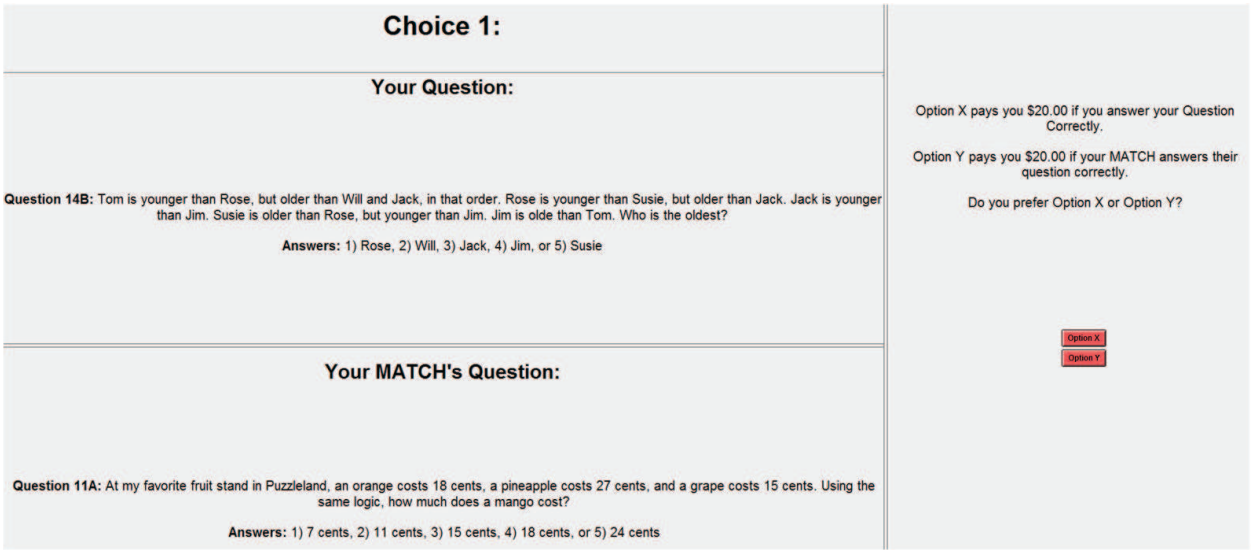


Figure 5: Binary Choice: *No Probability* condition

NP condition.[15] The chosen asset paid off in 454 (40.2%) of these 1129 decisions, yielding an expected earnings from the asset choice of $8.04. Average total earnings across all sessions were approximately $17.

We begin the analysis of the data from the three principal conditions by treating each binary choice as an independent observation.[16] We then turn to individual behavior, examining the consistency of each participant's choices across their session. Finally, we compare behavior across the three main conditions and analyze the results of the NP condition. In the Appendix, we provide a more further analysis of the accuracy and formation of beliefs as well as the findings of the post-quiz questionnaire.

[15] For the first six sessions, the program recorded a default likelihood of 0 if no likelihood was entered, so subjects were unable to distinguish whether their Match failed to make an estimate in time, or they actively entered a probability of zero. Thus, for these six sessions, *all* binary choices where $p^s = 0$ *or* $p^m = 0$ are omitted from our analysis.

[16] In other words, we begin by ignoring individual effects.

3.1 Aggregate Analysis

Subjects retain control of their financial outcome by choosing to be paid based on their own performance (Asset S), rather than that of their Match (Asset M). As each question answered by each participant is equally likely to appear as Asset S or Asset M, Asset S is objectively more likely to pay off than Asset M in 50% of binary choices in the sample. Thus, accurate beliefs combined with expected-money maximization would result in Asset S being chosen in half of the decisions.

However, inaccurate beliefs or a preference for or against control could cause this proportion to deviate from 50%. Table 1 summarizes the frequency with which participants opt for self-reliance. The first row of Table 1 summarizes participants' choices in the three principal conditions. The first column displays the percentage of binary choices that favor Asset S, nearly 60% of all binary choices.

Table 1: Choice of asset S in the three principal conditions

	Asset S Chosen	***p*-max strategy**	**CP Effect**	**Obs.**
All Binary Choices	59.9	56.3	3.4	813
Close Calls: $\lvert p^s - p^m \rvert \leq 0.10$	65.8	53.8	12.0	234

Having elicited beliefs about each asset, we can assess directly whether participants choose the asset with the higher estimated probability of success, a behavior that we refer to as following the p-max strategy. The second column of Table 1 displays the frequency with which participants *would* have chosen Asset S if they had always followed the p-max strategy, calculated as the proportion of choices for which $p^s > p^m$ plus exactly half of the instances for which $p^s = p^m$. In this counterfactual, Asset S is favored in 56.3% of the choices, which is a significantly greater proportion ($p < .01$, binomial) than the 50% predicted from an expected-money maximizer with accurate beliefs, implicating overconfidence as a major contributor to the preference for Asset S.

However, there remains a 3.4 percentage-point gap between the 59.9% of the instances in which Asset S actually was chosen and the 56.3% expected if participants had followed the p-max strategy. This residual, which we call the *control premium (CP) effect* and display in the third column of the table, reflects an aggregate preference for Asset S that is independent of its perceived monetary return. This effect is highly significant at the 99% level, according to the nonparametric McNemar's test. Thus, we attribute more than one third (34%) of the 9.9 percentage-point deviation from correct-belief-expected-money-maximization to a willingness to pay for control, rather than overconfidence.

Because a preference for payoff autonomy is more likely to impact behavior when the differences in expected earnings are small, we now focus on the subset of the binary choices for which p^s and p^m are within 0.1 of each other, shown in the bottom row of Table 1. Unsurprisingly, p-max strategy would select Asset S in very nearly 50% of binary choices, as this subset of choices incorporates participants' overconfidence. Despite the lower p-max prediction, the 65.8% rate at which Asset S is chosen is higher than in the overall sample. McNemar's test rejects the hypothesis ($p < 0.001$) that the 12.0 percentage-point residual is equal to zero. Binary choices in the 'Close Calls' category constitute 29% of the overall sample, and account for 66% of the violations of the p-max strategy. The control premium mainly affects choices for which the difference in expected returns for the two assets is small, but it plays a major role in these choices. In other words, participants are sensitive to the cost of control, as if the premium they are willing to pay for control is stable and well-behaved.

This price sensitivity is further illustrated in Figure 6, which charts the frequency with which Asset S is chosen for various levels of $p^s - p^m$. When $|p^s - p^m| > 0.20$, subjects almost exclusively conform to the p-max strategy. We see low levels of deviation when $0.10 < |p^s - p^m| \leq 0.20$ and even more when $0 < |p^s - p^m| \leq 0.10$, in both cases with greater deviation to the left of zero, where deviating comes in the form of favoring Asset S at a cost. Importantly, choices at $p^s - p^m = 0$ heavily favor Asset S.

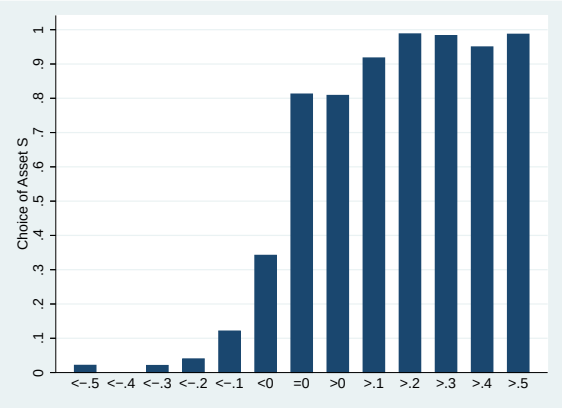


Figure 6: Rate of choosing Asset S, by $p^s - p^m$.

3.2 Individual Analysis

Next, we examine behavior at the individual level. First we examine the frequency with which each individual participant chose to sacrifice expected earnings to retain or avoid control. Then we analyze the extent to which each individual's behavior was consistent with a well-behaved decision rule that trades-off expected returns for control, and make comparisons across such participants.

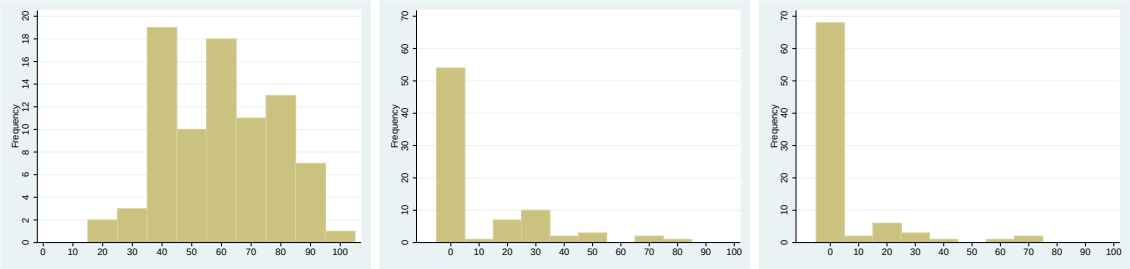
The histograms in Figure 7 categorize individual behavior by the fraction of times the participant chose a particular asset. Panel 7(a) categorizes each person by the percentage of times in the entire session that she choose Asset S.[17] It represents the behavior of 84 participants, pooled from the three main conditions.[18] With the exception of one participant, who chose S all 10 times, all participants chose both assets at least once with a large majority doing so in 40% to 80% of the decisions.[19]

Figure 7(b) identifies individuals by the percentage of their decisions for which they chose

[17] The horizontal axes in Figure 7 are indexed by percentage, rather than number, of choices to allow more natural comparisons for participants who had one or more choices timed out, and therefore had fewer than ten binary choices represented in our data.

[18] After eliminating binary choices due to time-outs, one subject had only one binary choice remaining, and another had three. We omit these two subjects from our analysis of individual behavior.

[19] This participant took part in the *Baseline* condition, and faced $p^s > p^m$ in each choice. Thus, he never violated the p-max strategy, and never had the opportunity to express a positive control premium.



(a) Asset S Percentage

(b) Percentage of choices exhibiting positive control premium

(c) Percentage of choices exhibiting negative control premium

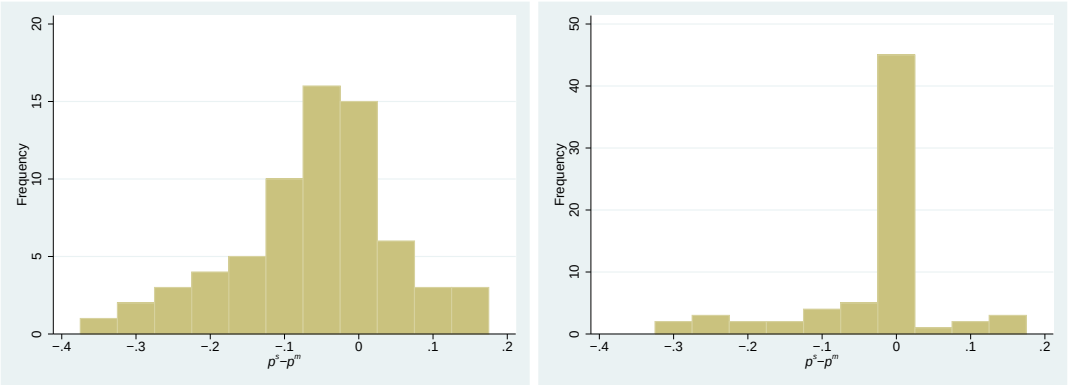
Figure 7: Histograms classifying individual behavior using three different categories

to retain control when doing so was costly. Specifically, we divide the number of decisions for which $p^s < p^m$ and the participant chose Asset S, by the total number of decisions for which $p^s < p^m$. The large spike at zero indicates that most participants chose Asset S whenever $p^s < p^m$. However, the histogram also reveals that quite a few participants that chose to retain control a large fraction of the opportunities for which doing so would violate the p-max strategy. In fact, 26 of the 83 participants (31.3%) who had at least one opportunity to retain control at a cost, chose to do so at least once. Conversely, we computed for each participant the percentage of decisions in which $p^m < p^s$ for which she chooses Asset M. Figure 7(c), the histogram of these percentages, reveals that most participants simply follow the p-max strategy in these instances, but fifteen people at least once chose Asset M after having stated the belief that it was less likely to pay than Asset S.

While Figure 7 shows that quite a few participants always choose the asset with the higher expected payoff, it also highlights the behavior of the 39 out 84 who did not adhere to the p-max strategy. We next consider the extent to which the behavior of these participants was consistent with a price-sensitive decision rule. We begin by noting that as the difference $(p^s - p^m)$ increases, Asset S becomes relatively more attractive. If participants substitute a valuation of payoff autonomy, whether positive, zero, or negative, for expected earnings, binary choices will be determined by a *cutoff strategy* in $(p^s - p^m)$, choosing Asset S whenever $(p^s - p^m)$ exceeds some cutoff $\hat{p}$ and choosing Asset S whenever $(p^s - p^m)$ falls short of $\hat{p}$.

The p-max strategy corresponds to a cutoff of $(p^s - p^m) = 0$. However, a person willing to pay a premium to retain or avoid payoff autonomy would employ a non-zero cutoff, with $\hat{p} < 0$ corresponding to a positive premium on control and $\hat{p} > 0$ corresponding to a negative control premium.

A participant's behavior is consistent with a cutoff strategy if the minimum value of $(p^s - p^m)$ for which she chooses asset S, which we denote $\underline{p^s}$, is no less than the maximum value of $(p^s - p^m)$ for which she chooses asset M, denoted $\overline{p^m}$. Sixty-nine out of 84 (82%) of the participants behaved in a manner consistent with a cutoff strategy. Of the 39 participants (62%) who did *not* adhere strictly to the p-max strategy, the behavior of 24 was still consistent with a cutoff.



(a) All 3 Conditions: Midpoint

(b) All 3 Conditions: Zero Default

Figure 8: Cutoffs in $p^s - p^m$

We do not observe cutoffs directly, so we impute them for the 69 participants with cutoff-consistent behavior. Because the cutoff is bounded by $\underline{p^m}$ and $\overline{p^s}$, we begin by applying a simple 'midpoint rule' that assigns the cutoff to be $\hat{p} = (\underline{p^m} + \overline{p^s})/2$.[20] Figure 8(a) displays the distribution of cutoffs calculated according to this rule. While peaked at zero, the cutoffs range from -0.475 to 0.275 and the distribution is clearly skewed to the left. Forty-five

[20] Using this method to compute the cutoff, we exclude the one participant who had $p^s > p^m$ in every choice and thus, for who $\overline{p^m}$ is undefined.

participants exhibit a positive control premium, 10 have a cutoff of zero, and 13 have a negative control premium, when cutoffs are calculated in this way.

The top row of Table 2 displays the mean cutoff and the mean conditional on displaying a positive control premium ($\hat{p} < 0$), calculated using the midpoint rule. The mean cutoff of -0.0597 is significantly less than zero, equivalent to a willingness to relinquish \$1.19 of expected return to retain payoff autonomy. Among the 45 individuals exhibiting a positive control premium, the average cutoff is -0.1119, corresponding to a premium of \$2.24 on control.

Table 2: Mean individual cutoff and the mean conditional on $\hat{p} < 0$

	$\bar{\hat{p}}$	Obs.	$\bar{\hat{p}}$ given < 0	Obs.
Midpoint Rule	$-.0597$	68	$-.01119$	45
	$(.0131)^{***}$		$(.0136)^{***}$	
Default Zero Rule	$-.0308$	69	$-.1512$	18
	$(.0110)^{***}$		$(.0222)^{***}$	

[a] Standard error in parentheses.

[b] $***$,$**$ and $*$ signify significant difference from zero according to a two-sided t-test, at the 1%, 5% and 10% levels, respectively.

[c] Sample size in brackets.

While illustrative, the midpoint rule has the drawback of assigning a non-zero cutoff to some participants who never expressly violate the p-max strategy.[21] A more conservative approach is to assign a default cutoff of $\hat{p} = 0$ to all participants who never violate the p-max strategy, and to use the midpoint rule for those who are consitent with a cutoff in $p^s - p^m$, but deviate from the p-max strategy at some point. This 'default-zero' rule reassigns a zero cutoff to 27 participants classified as having a positive control premium under the midpoint

[21] For example, the rule estimates the cutoff of a participant for whom $\underline{p^m} = -0.20$ and $\overline{p^s} = 0$ as $(\underline{p^m} + \overline{p^s})/2 = -0.10$, though her choices are *consistent* with a cutoff of zero.

rule and does so to 7 classified as having a negative control premium.[22]

Figure 8(b) shows the cutoffs obtained under the default-zero rule. While 34 participants' cutoffs are re-classified as zero under this stricter rule, 24 of 69 (34.8%) still deviate from zero, with 18 indicative of a positive control premium, and only six of a negative. The mean and conditional mean cutoffs calculated under the default-zero rule are shown in the bottom panel of Table 2. With more individuals assigned $\hat{p} = 0$, the average cutoff drops to -0.0308. Despite this, the difference from zero is still highly significant. Furthermore, the more conservative cutoff assignment yields a more extreme conditional mean cutoff of -0.1512. These cutoffs equate to a willingness to pay \$0.62 and \$3.02, respectively.

The difference in results between the midpoint and default-zero rules warrants mention. Under the latter, 45 participants have cutoffs estimated to be zero. Of these 45, 19 never faced a choice in which $p^s - p^m = 0$. Of the 26 that did face such a choice, 19 chose asset S in each case where $p^s - p^m = 0$, two chose asset M in all such choices, and five chose each asset at least once. Hence, a significant majority of participants whose behavior was *consistent* with the p-max strategy nonetheless always choose asset S in the case of ties. This residual 'weak' preference for asset S explains the magnitude of the difference in $\hat{p}$ between the two estimation methods.

3.3 Comparisons Across Conditions: the Effect of Reducing Ambiguity

Next, we compare the control premium across the three principal conditions, which will help illuminate the influence of ambiguity aversion on our results. Table 3 shows the same binary choice and cutoff data displayed in Tables 1 and 2, broken down by experimental condition. Across the BL, RA and MA conditions, the proportion of choices that favor asset M remains consistently close to 60%. The aggregate control premium is 4.4 and 5.8 percentage-points ($p = .06$ and $p = .04$) in the BL and RA conditions, respectively, but drops to a negligible level (0.4) in the MA condition. Similarly, among the 'Close Calls', the difference between the

[22] This rule also assigns a zero cutoff to the participant who chose asset S in each choice.

choice of Asset S and the p-max strategy increases from condition BL to RA, and decreases dramatically in condition MA. Thus, while providing information about the Match's stated beliefs in the RA condition does not reduce the control premium, the additional information provided in the MA condition appears to do so.

However, a closer look reveals that the evidence for a decreased control premium in the MA condition is less than robust. While choices consistent only with a positive control premium occurred with a slightly higher frequency in the MA condition (12.5%) than the other two conditions (11.45%), choices consistent only with a negative control premium occurred much more frequently (11.7% vs. 4.27%) in the MA condition. This is largely driven by a small cluster of participants making several negative-control-premium choices. Of the seven participants making multiple such choices, five participated in the MA condition.[23]

Furthermore, analysis of the individual cutoffs provides no support for the claim that the information provided in the RA and MA conditions weakens the control premium. The bottom panel of Table 3 compares the cutoffs, estimated using both the midpoint rule and the default-zero rule, across the three experimental conditions. At the individual level, the average control premium *rises* monotonically—from 4.09 to 6.85 to 7.73 percentage points under the midpoint rule and from 1.84 to 2.14 to 5.80 points under the default-zero rule. Conditional on a negative cutoff, the average control premium rises almost monotonically under both rules as well. This may seem at odds with the aggregate data, however, as mentioned above, a small number of participants frequently choose asset M when $p^s > p^m$, which counteracts a more widespread, but subtle, preference for asset S, when the choices are pooled. As each subject is represented equally in the bottom panel, the more generally expressed *positive* control premium is manifest.

[23] In fact, one participant in the MA condition, whose choices were not consistent with a cutoff strategy, makes six such choices, significantly skewing the measured aggregate control premium.

Table 3: Cross-Condition Comparison

	Binary Choices							
	All Binary Choices				Close Calls: $\lvert p^s - p^m \rvert \leq 10\%$			
	Actual	***p*-max**	**CP Effect**	Obs	**Actual**	***p*-max**	**Difference**	Obs.
Overall	59.9	56.3	3.6	813	65.8	53.8	12.0	234
BL	60.6	56.2	4.4	315	66.0	54.1	11.9	109
RA	59.1	53.3	5.8	240	64.5	45.2	19.7	62
MA	59.7	59.3	0.4	258	66.7	61.9	4.8	63

	Cutoffs							
	Midpoint Rule				**Default-Zero Rule**			
	$\bar{\hat{p}}$	Obs.	$\bar{\hat{p}}$ given < 0	Obs.	$\bar{\hat{p}}$	Obs.	$\bar{\hat{p}}$ given < 0	Obs.
Overall	$-.0597$	68	$-.1119$	45	$-.0308$	69	$-.1512$	18
	$(.0131)^{***}$		$(.0136)^{***}$		$(.0110)^{***}$		$(.0222)^{***}$	
BL	$-.0409$	28	$-.0944$	17	$-.0184$	29	$-.1286$	7
	$(.0176)^{**}$		$(.0178)^{***}$		$(.0148)$		$(.0283)^{***}$	
RA	$-.0685$	20	$-.01150$	14	$-.0214$	20	$-.1259$	4
	$(.0257)^{**}$		$(.0277)^{***}$		$(.0164)$		$(.0591)$	
MA	$-.0773$	20	$-.1299$	14	$-.0580$	20	$-.1882$	7
	$(.0271)^{**}$		$(.0267)^{***}$		$(.0264)^{**}$		$(.0378)^{***}$	

[a] Excludes results from the *No Probability* condition.

[b] Standard error in parentheses.

[c] $***$,$**$ and $*$ denotes significant difference from zero according to a two-sided t-test, at the 1%, 5% and 10% levels, respectively.

3.4 *No Probability* Condition

Participants in the *No Probability* (NP) condition simply view both their own question and their Match's, as displayed in Figure 5, and choose which they would prefer their payment

to depend on. Lacking p^s and p^m, we can neither calculate cutoffs nor characterize the control premium at the individual level. We can, however, compare aggregate behavior across conditions. Asset S is chosen in 64.9% of the decisions in the NP condition, a higher rate ($p = .07$, Fisher's exact test) than in the 59.9% observed in the three principal conditions. This supports our characterization of our results as a lower-bound for the control premium.

Further, we can make a between-subjects comparison between the choices from the NP condition and those from the three principal conditions to deduce an *aggregate* cutoff for participants in the NP condition. Roughly 65% of choices in the NP condition favor asset S. Thus, the 35th percentile of $p^s - p^m$ in the three principal conditions[24] is a reasonable estimate for the value of $p^s - p^m$ for which participants in the NP condition are indifferent between assets S and M. This cutoff value, -0.070, reflects a stronger aggregate preference for control than we calculated from the three principal conditions, using both the midpoint and default-zero rules. Thus, both the aggregate analysis and the individual cutoff calculations support the claim that the salience of the expressed probabilities in the three main conditions dampens the expression of the control premium.

4 Conclusion

We show that many people have an intrinsic preference to control their own payoffs, much of which cannot be explained by overconfidence. This affects the decision to delegate at both the aggregate and individual levels. These findings have potentially significant implications across many domains, as many activities in both private and public life, including investment, management, and health-care delivery, involve a decision of whether or not to delegate decisions and actions to others.

A population of expected-money maximizers with accurate beliefs would choose to determine their own payoffs in 50% of the binary decisions. Our participants exceed this rate by

[24] Recall that participants in the three principal conditions were unaware of the binary choices when they estimated p^s and p^m. This makes the between-subjects use of p^s and p^m quite valid.

9.9 percentage-points in the three principal conditions. Eliciting participants' beliefs *before* participants make these binary decisions allows us to conclude that overconfidence plays an important role, but 34% of the discrepancy is driven by the control premium. Because providing more information to the decision-maker about the ability and beliefs of her Match and about the difficulty of his question fail to diminish the average individual willingness-to-pay for control, we conclude that the control premium exists independent of ambiguity aversion.

The fact that participants in the *No Probability* condition rely on their own quiz performance more frequently than those in the three principal conditions suggests that our primary measure of the control premium effect understates the extent to which the control premium drives excess self-reliance. For example, a hypothetical between-subjects design could elicit participants' beliefs in one treatment, and have them make binary asset choices in another. We can construct such an experiment from our data, comparing the beliefs expressed in the three principal conditions with the choices in the *NP* condition. This comparison would conclude that a full 58%[25] of the deviation from accurate-belief-money-maximizing behavior cannot be explained by overconfident beliefs, further obscuring the relationship between beliefs and choices.

We use the results of Hoelzl and Rustichini (2005) to illustrate the potential pitfalls of relying unhesitatingly on choice data to characterize beliefs. Each participant in their experiment completed a test, then voted either to have her payment determined by whether or not she scored above the median or to have it determined by the outcome of a 50-50 lottery. Participants in their *Easy, Money* condition vote for the test-based payment 63%, rather than 50%, of the time, which the authors interpret as evidence of overconfidence in the population. However, if, like in our experiment, 34% to 58% of the excess self-reliance cannot be attributed to beliefs, then a more accurate interpretation of their result is that overconfidence explains 5.5 to 8.6 percentage points of deviation from 50%, while 4.4 to 7.5 percentage points can only be explained by a desire for control. Thus, careful attention to

[25] 64.9% of choices favored asset S in the *NP* condition, while the p-max strategy does so at a rate of 56.3% across the three principal conditions.

the influence of preferences versus beliefs in generating self-reliance can yield more sound behavioral and welfare interpretations of experimental results.

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A Supplemental Results

A.1 Formation and Accuracy of Beliefs

While the focus of this paper is on the choice between Assets S and M, the determinants and accuracy of p^s and p^m warrant some discussion. Because participants in the *BL* condition receive no supplemental information before expressing p^s and p^m, their reports are influenced only by their impression of the question and their broader beliefs about themselves and their Match. In the *RA* condition, participants also learn the p^s expressed by their Match before entering p^m, giving them a measure of their Match's self-confidence. Participants in the *MA* condition are the most informed, additionally learning both their own and their Match's score on a ten-question 'pre-quiz' made up of similar questions, as well as the proportion of previous participants that answered each individual question correctly. Thus, participants in *MA* have three different pieces of information on which to base p^s and p^m, in addition to any intuition that they have about its difficulty and about their colleagues.

Table 4 displays the results of OLS regressions of the probability estimates on all available informations. The top panel shows the factors influencing p^s, and the bottom those influencing p^m. In both panels, a dummy 'Correct Answer' is included, which is one if and only if the question being estimated was answered correctly. Its coefficient shows whether, after all information is controlled for, participants' estimates are correlated with the target questions' outcomes.

Columns *(1)*, *(2)* and *(3)* show regressions for each of the main conditions, with the *Correct Answer* dummy and no other covariates. Thus, the coefficient on the dummy variable show by how much p^s and p^m for correct answers exceed those for incorrect answers. In the *BL* condition, correct answers only weakly predict correct answers, as evidenced by the positive but small coefficients on the *Correct Answer* dummy. The predictive power of p^s and p^m is only slightly stronger in the *RA* condition. The correlation improves for the *MA* condition, as evidenced by the higher coefficients on the dummy variable in column *(3)*. The simple regressions in columns, *(1)* and *(2)* also show the extreme overconfidence expressed

Table 4: Formation of Probability Estimates

	Dependent Variable: p^s				
	BL	*RA*	*MA*		*MA*
	(1)	*(2)*	*(3)*		*(6)*
Correct Answer	.048	.065	.145		.022
	(.026)*	(.029)**	(.036)***		(.030)
Pretest Prop. Correct	—	—	—		.179
	—	—	—		(.119)
Population Prop. Correct	—	—	—		.441
	—	—	—		(.089***)
Constant	.615	.641	.466		.270
	(.027)***	(.029)***	(.032)***		(.071)***

	Dependent Variable: p^m						
	BL	*RA*	*MA*	*RA*	*MA*	*MA*	*MA*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Correct Answer	.042	.074	.162	.043	.040	−.002	−.031
	(.027)	(.026)***	(.032)***	(.024)*	(.026)	(.030)	(.022)
Pretest Prop. Correct	—	—	—	—	—	.132	.047
	—	—	—	—	—	(.098)	(.083)
Population Prop. Correct	—	—	—	—	—	.596	.331
	—	—	—	—	—	(.094)***	(.068)***
$p^s(Match)$	—	—	—	.633	.691	—	.590
	—	—	—	(.067)***	(.071)***	—	(.075)***
Constant	.595	.594	.401	.241	.094	.179	.025
	(.021)***	(.032)***	(.025)***	(.042)***	(.038)**	(.059)***	(.043)

[a] Standard error, clustered by subject, in parentheses.

[b] $***$,$**$ and $*$ signify significance at the 1%, 5% and 10% levels, respectively.

participants in the *BL* and *RA* conditions. The *Constant* term shows that the average p^s expressed for incorrect answers was greater than 60%, and the average p^m was only slightly lower. The additional information provided in *MA* decreased overconfidence, as the constant term is lower for both p^s and p^m in column *(3)*.

Several meaningful comparisons can be made among columns *(4-7)*, of which we highlight a few. First, in these regressions, the *Correct Answer* has little explanatory power, after controlling for the supplemental information that participants receive. Thus, participants show little ability to assess the likelihood of any question being answered correctly that is not captured by the pretest and population data. Second, comparing column *(6)* in the top panel to that in the bottom suggests that participants in the *MA* condition were more influenced by pre-quiz performance when assessing their own performance, and more by population success rates when assessing that of others. The coefficients of both decrease in column *(7)*, however, suggesting that much of their informativeness is captured in $p^s(Match)$. Finally, the coefficient on $p^s(Match)$ is near .6 in columns *(3)* and *(6)*, suggesting that participants' estimates of their Match's performance are somewhat regressive, as increasing the observed p^s by ten percentage points increases the expressed p^m by six.

A.2 Questionnaire Results

Table 5 shows a number of descriptive statistics: mean total quiz score; mean overconfidence, measured as the sum of the reported probabilities minus the total score; mean frequency of choosing Asset S; and the mean cutoff, calculated separately for each of the two rules. These statistics are partitioned according to several demographic and personality traits: gender, age, the score on the Burger-Cooper (BC) desire-for-control scale, and course of study. No measure of behavior differs dramatically by gender. Younger participants, those scoring lower on the Burger-Cooper (BC) Burger and Cooper (1979) test, and Business and Economics (B&E) majors score higher on their quiz than do their counterparts. The latter two groups are also less overconfident, but this could be largely caused by regression to the

Table 5: Summary statistics by demographic characteristics

	Quiz score[a]	**Overconfidence**[a c]	**Asset S**[b] **Chosen**	**Midpoint Rule**[a] **Cutoff**	**Default Zero**[a] **Cutoff**
Female	3.89 (0.20)	2.18 (0.29)	60.8% (561)	−.0625 (.0184)	−.0166 (.0130)
Male	4.14 (0.25)	2.15 (0.26)	62.8% (460)	−.0416 (.0199)	−.0296 (.0173)
Age ≤ 22	4.10 (0.17)*	2.04 (0.21)	61.8% (887)	−.0538 (.0129)	−.0245 (.0105)
Age > 22	3.51 (0.34)*	2.68 (0.57)	60.4% (134)	−.0532 (.0505)	−.0100 (.0350)
Hi BC	3.66 (0.20)**	2.74 (0.30)***	59.2% (471)	−.0488 (.0225)	−.0214 (.0164)
Lo BC	4.35 (0.23)**	1.67 (0.25)***	63.8% (550)	−.0584 (.0156)	−.0225 (.0134)
Bus-Econ Major	4.41 (0.27)**	1.73 (0.25)**	64.7% (422)	−.0698 (.0206)	−.0358 (.0174)
Other	3.72 (0.18)**	2.46 (0.29)**	59.6% (599)	−.0418 (.0179)	−.0115 (.0126)

[a] Standard error in parentheses, significance based on one-sample t-test.

[b] Number of observations in parentheses, significance based on chi-squared tests.

[c] **Overconfidence** is calculated as $\sum_{i=1}^{10} p_i^s - QuizScore$.

[d] ***,**,*: significant difference at 1, 5 and 10% level.

mean. B&E majors have more extreme cutoffs than their counterparts from other majors, but this difference does not achieve significance.[26]

[26]The sample size is reduced in Table 5 due to a computer malfunction in one of the treatments from the MA condition. All binary choice and quiz data was preserved, but data on demographics was lost, so data for 13 participants is not represented in this table.

B Instruments and Instructions

B.1 Quizzes and Answers

Question Number	Question Text	Answer 1	Answer 2	Answer 3	Answer 4	Answer 5	Correct Answer Number
1	At my favorite fruit stand in Puzzleland, an orange costs 18 cents, a pineapple costs 27 cents, and a grape costs 15 cents. Using the same logic, how much does a mango cost?	7 cents	11 cents	15 cents	18 cents	24 cents	3
2	Before losing my wallet, I made two purchases. The first purchase cost exactly 10% of the original amount in my wallet. The second purchase cost exactly 10% of what I had left. The amount of the two purchases totaled $19. How much money was left in my wallet when I lost it?	$31	$50	$81	$100	$131	3
3	I stroll daily for 12 miles at a speed of 2 miles per hour. If I jogged three times faster, how much time would I save	1 hour	2 hours	3 hours	4 hours	6 hours	4
4	Margot likes knights but not battlers. She likes writing but not typing. She likes to listen but not to sing. What type of author does she like?	unknown	famous	contemporary	dramatic	romantic	1
5	The Great Detective is in pursuit of the guilty party (or parties). He is now interrogating three suspects. George says "I'm innocent - Jane is too." Jane says, "Sally did it, and George is innocent." Sally says, "I'm innocent and Jane did it." The guilty party (or parties) told only lies, and the innocent ones told the truth. Who is the perpetrator (or perpetrators)?	George	Jane	Sally	George and Jane	George and Sally	3
6	The following words below have one significant feature in common which distinguishes them from the fifth word. Which is the odd man out?	REACT	TRACE	CARTE	CATER	SCARE	5
7	Which set of lettters would logically come next in the following sequence? A Y D V G S J P M M P J _ _	R K	S G	R S	S I	X Y	2
8	Cleaning out your couch cushions, you found exactly the same number each of nickels, dimes and quarters. How much money did you find?	$2.60	$3.00	$3.40	$3.50	$3.60	5
9	Tom is younger than Rose, but older than Will and Jack, in that order. Rose is younger than Susie, but older than Jack. Jack is younger than Jim. Susie is older than Rose, but younger than Jim. Jim is olde than Tom. Who is the oldest?	Rose	Will	Jack	Jim	Susie	4
10	You can buy 4 chocolate bars and 3 peanut butter cups for 50 cents. You can buy 3 chocolate bars and 4 peanut butter cups for 48 cents. What is the greatest number of TOTAL pieces of candy that you can buy for 50 cents?	7	8	9	10	12	2
1A	If you count from 1 to 100, how many 7's will you pass on the way?	10	11	19	20	21	4
2A	Jake's jalopy uses 10 gallons of gas for a trip of 150 miles. Sam's speedster gets half the mileage that Jake's does. Hal's heap uses 10 gallons for two thirds the distance that Jake can go with his jalopy. How many gallons does Hal need to go 250 miles?	10 Gallons	12.5 Gallons	20 Gallons	25 gallons	50 gallons	4
3A	If through and threw are pronounced the same, cross out all of the even numbers in the line below. If they are not, cross out all of the odd numbers. If Albany is the capital of New York State, add all of the numbers that are left. If it is not, multiply all of the numbers left. Your answer? 1 2 3 1 2 3 1 2 3 1 2 3	16	8	256	64	32	1
4A	A man moors his boat in a harbor at high tide. A ladder is fastened to the boat, with three rungs showing. The rungs are twelve inches apart. At low tide the water level sinks twenty feet. How many rungs of the ladder are showing now?	3	8	14	20	25	1
5A	A man bets $24 and gets back his original bet and $48 additional. He spends 25 percent of his winnings at a restaurant to celebrate, and 50 percent of his winnings to buy a present for his wife because he was so late, and his salary was $240, from which he made his original bet. How much money does he have left when he finally arrives home?	$240	$244	$252	$258	$264	3
6A	Which number in the following series of numbers does not belong? (1, 3, 5, 9, 11	1	3	5	9	11	4
7A	What word is the opposite of the following scrambled word? WACCORDIE	INDUSTRY	SYMPATHY	BRAVERY	LAZINESS	SIMILARITY	3
8A	Robert and Rose went shopping for presents together. They had a total of $264 between them. Rose had $24 more to begin with but she spent twice as much as Robert and ended up with two-thirds as much money as Robert. How much did Robert spend?	$48	$72	$120	$96	$56	1
9A	In a foreign language, "fol birta klar" means "shine red applies." The phrase "pirt klar farn" means "big red bicycles," and "obirts fol pirt" means "shine bicycles often." How would you say "big apples" in this language?	"fol klar"	"birta farn"	"obirts farn"	"birta pirt"	"pirt fol"	2
10A	What is the next entry in the following sequence: 2, T, 4, F, 8, E, 16, S, 32, T, 64, _____	T	F	E	R	S	5
1B	If 8-22-5-22-13 equates to seven, and 7-4-12 makes two, how would you write ten?	12-4-14	7-22-13	7-22-14	20-5-14	20-5-13	2
2B	A girl decides to take a long walk in the country and visit a friend on the way. She walks at a steady pace of 2 and a half miles per hour. She spends 4 hours walking over to her friend's house; she has a cup of coffee and a sandwich and talks to her friend all of which occupies an hour, and then her friend runs her home in the car, over some rough road, at 20 miles per hour. She gets home at 2:30 in the afternoon. When did she leave her house in the morning?	9AM	8AM	7AM	9:30AM	10:30AM	1
3B	You have 24 socks in a drawer, 6 each of brown, black, white and red. How many socks must you take out of the drawer, without looking, to be sure of having a matched pair (of any color)?	5	4	9	8	2	1
4B	Which of the lettered words could logically come next in the following sequence? APE BIRD CAN DIG EA_	MAN	HAT	CARTE	SEA	FIG	5
5B	A man goes to visit his friend thirty miles away. He doesn't mind speeding, so he travels at 60 miles per hour (mph) and arrives in half an hour. On the way back, however, he has a little trouble with his car, and it takes him an hour to reach home. What was his average speed for the round trip?	40 mph	30 mph	45 mph	60 mph	20 mph	1
6B	How many minutes is it before six o'clock if fifty minutes ago it was four times as many minutes past three o'clock	22	23	24	25	26	5
7B	What is the next number in the following sequence: 1, 2, 6, 30, 60, 180, 900, 1800, 5400, _____	10800	16200	21600	27000	32400	4
8B	If the length of a rectangle is increased by 25% and the width is decreased by 25%, what is the percentage change in its area from its original amount?	-10%	-6.25%	0%	6.25%	10%	2
9B	If 7^33 is divided by 10, what will the remainder be?	0	1	4	7	9	4
10B	Following the pattern shown in the number sequence below, what is the missing number: 1, 8, 27, ? , 125, 21	36	45	46	64	99	4

Appendix B.2.1 Part 1 Instructions for Baseline Condition

Introduction

Thank you for participating in this experiment. Please follow along carefully as the experimenter reads through these instructions. If you have any questions, please do not hesitate to raise your hand.

This is an experiment in the economics of decision-making. A research foundation has provided funds for conducting this research.

For your participation, you will be paid privately and in cash at the end of this session. Your earnings will depend partly on your decisions, partly on the decisions of others, and partly on chance. If you follow the instructions and make careful decisions, you increase your chance of earning more money.

You will receive $5 as a participation fee (simply for showing up on time). Details of how you will make decisions and gain subsequent earnings are provided below.

Four-part experiment

The experiment has four parts, Part 1, Part 2, Part 3 and Part 4. Part 4 is a questionnaire that we ask you to complete while we arrange your payment. Your answers in Part 4 will not affect your payment in any way.

To determine further earnings (beyond the $5 participation fee), you will be randomly assigned to one of 3 Groups. You are equally likely to be assigned to Group 1, Group 2 and Group 3. If you are assigned to Group 1, your earnings will be determined by Part 1 of the experiment. If you are assigned to Group 2, your earnings will be determined by Part 2, and if you are assigned to Group 3, they will be determined by Part 3.

Overview

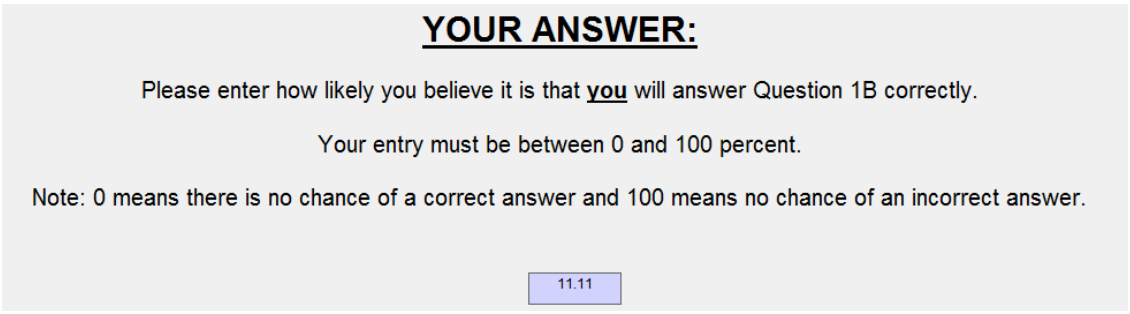
This experiment consists of two separate 10 question quizzes, Quiz A and Quiz B. The questions of Quiz A are labeled 1A, 2A, 3A....10A, and the questions of Quiz B are labeled 1B, 2B, 3B...10B. In Part 3 of the experiment, you will take ONE of the two Quizzes. Roughly half of the participants in the room will take each quiz. The questions to each Quiz are all multiple-choice with 5 possible answers, and most are logic or mathematics puzzles drawn from Mensa © publications. In Part 3, each participant will have a *full minute* to answer each of the 10 questions of their Quiz, and will have the financial incentive to answer questions correctly.

You will be randomly paired with another participant in the room. We will refer to this participant as your **MATCH.** Your **MATCH** will **not** be taking the same quiz as you (if you are taking Quiz A, your match will be taking Quiz B, and vice-versa). The identity of your **MATCH** will remain constant for the entirety of the Experiment, but their identity will never be revealed to you.

At this time, we will read instructions for Part 1 of the experiment. We will read instructions for the remainder of the experiment *after* you have completed Part 1.

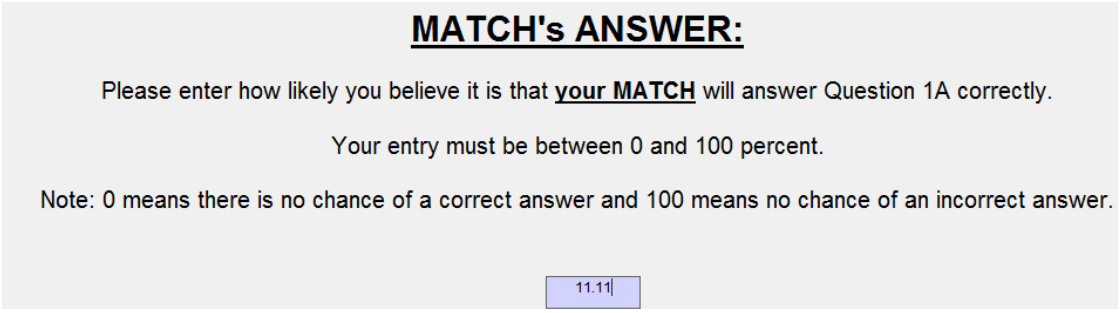
Instructions for Part 1

When Part 1 begins, you will view Question 1 from YOUR quiz (the one that you will take in Part 3) for 15 seconds. After viewing the question, you will be asked to estimate how likely you are to answer this question correctly in Part 3. Recall that, in Part 3, you will have a full minute (60 seconds) to answer the question, and have a financial incentive to do so. You will enter the likelihood in a screen like the one pictured below.



You will have 15 seconds to enter a likelihood, after the first question disappears. After you have entered the likelihood, press the button market "Next", and you will continue to the next question. If you do not enter a likelihood within 15 seconds, the computer will record the likelihood as 0.00%, and you will automatically move on to the next screen.

The 2nd question that you view will be the Question 1 from your **MATCH**'s quiz. After viewing the question for 15 seconds, along with the 5 possible answers, you will be asked to estimate how likely your **MATCH** is to answer this question correctly in Part 3, when he or she will have a full minute (60 seconds) and a financial incentive to do so. You will enter your estimate in a screen like the one pictured below. Again, you will have to enter an estimate for the likelihood within 15 seconds, and to click "Next" to continue. If you do not enter a likelihood and click "Next" within 15 seconds, the computer will record the likelihood as 0.00%, and will automatically move on to the next screen.



The 3rd through 20th questions will proceed in the same manner as the 1st and 2nd. You will alternate between estimating the likelihood that YOU answer your own quiz questions correctly, and the likelihood that your **MATCH** will answer their quiz questions correctly.

After you have completed the process for each of the 20 questions, Part 1 of the experiment is over. At that time, a screen will appear that reads "We are now going to pause to read the next section of the instructions. Please do not touch your computer until instructed to do so." When you reach this screen, please wait patiently for the rest of the participants to finish Part 1. After they have finished, we will proceed with the next portion of the instructions.

Payment for Group 1

As previously stated, each participant has a 1/3 probability of having their earnings determined by Group 1. If you are assigned to Group 1, your payment will be determined as follows:

One of the 20 questions from the two quizzes will be randomly selected as the PAYMENT QUESTION, with each of the questions being equally likely. You will have estimated the likelihood that either you (your quiz) or your **MATCH** (their quiz) will answer this question correctly, in Part 3. This likelihood will be called L^{PQ}.

We will randomly choose a lottery for you, that will give you a some probability of earning $20. If this probability is *less than* the likelihood, L^{PQ}, that you estimated for the payment question, you will be paid based on the payment question. If this probability is *greater than* L^{PQ}, then you will be paid based on the lottery. Thus, accurately estimating each likelihood will maximize the probability that you earn the $20. Specific details are provided below:

The computer will randomly select two numbers, called the THRESHOLD (referred to as T) and the DETERMINANT (referred to as D). Both are equally likely to be any number between 0 and 100.

L^{PQ}, T and D will be used to determine your payment as follows:

- **If L^{PQ}<T, T and D will be used to determine your payment as follows:**
  - **You will earn $20 if T≥D.**
  - **You will earn $0 if T<D.**
- **If $L^{PQ} \geq$ T, the given answer to the PAYMENT QUESTION will determine your payment as follows:**
  - **If the PAYMENT QUESTION is from YOUR Quiz:**
    - **You will earn $20 if you answer the PAYMENT QUESTION correctly in Part 3.**
    - **You will earn $0 if you answer the PAYMENT QUESTION incorrectly in Part 3.**
  - **If the PAYMENT QUESTION is from your MATCH's Quiz:**
    - **You will earn $20 if your MATCH answers the PAYMENT QUESTION correctly in Part 3**
    - **You will earn $0 if your MATCH answers the PAYMENT QUESTION incorrectly in Part 3.**

This Group may seem complicated, but what it means for you is simple. You have the highest chance to earn $20 if you estimate each likelihood accurately. The Group has been constructed to ensure that you have the incentive to do so.

Rules

Please do not talk with anyone during the experiment. We ask everyone to remain silent until it is over.

Your participation in the experiment and any information about your earnings will be kept strictly confidential. Your payment's receipt and participant form are the only places in which your name and social security number are recorded.

Once the experimenter instructs you to do so, you may begin with Part 1 of the experiment.

After all participants have finished with Part 1 of the experiment, the Instructor will proceed with the instructions for Part 2.

During Part 1 of the experiment, you may not use a writing instrument of any kind, so please put away all pens and pencils.

Appendix B.2.2 Part 1 Instructions for Reduced Ambiguity Condition

Introduction

Thank you for participating in this experiment. Please follow along carefully as the experimenter reads through these instructions. If you have any questions, please do not hesitate to raise your hand.

This is an experiment in the economics of decision-making. A research foundation has provided funds for conducting this research.

For your participation, you will be paid privately and in cash at the end of this session. Your earnings will depend partly on your decisions, partly on the decisions of others, and partly on chance. If you follow the instructions and make careful decisions, you increase your chance of earning more money.

You will receive $5 as a participation fee (simply for showing up on time). Details of how you will make decisions and gain subsequent earnings are provided below.

Four-part experiment

The experiment has four parts, Part 1, Part 2, Part 3 and Part 4. Part 4 is a questionnaire that we ask you to complete while we arrange your payment. Your answers in Part 4 will not affect your payment in any way.

To determine further earnings (beyond the $5 participation fee), you will be randomly assigned to one of 3 Groups. You are equally likely to be assigned to Group 1, Group 2 and Group 3. If you are assigned to Group 1, your earnings will be determined by Part 1 of the experiment. If you are assigned to Group 2, your earnings will be determined by Part 2, and if you are assigned to Group 3, they will be determined by Part 3.

Overview

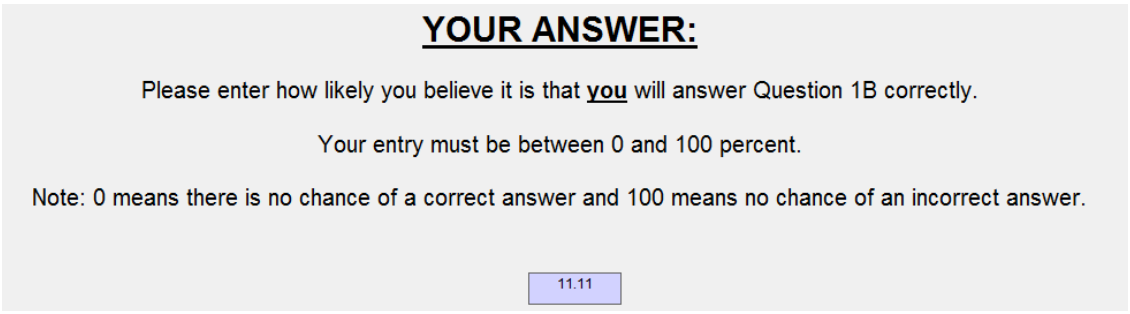
This experiment consists of two separate 10 question quizzes, Quiz A and Quiz B. The questions of Quiz A are labeled 1A, 2A, 3A....10A, and the questions of Quiz B are labeled 1B, 2B, 3B...10B. In Part 3 of the experiment, you will take ONE of the two Quizzes. Roughly half of the participants in the room will take each quiz. The questions to each Quiz are all multiple-choice with 5 possible answers, and most are logic or mathematics puzzles drawn from Mensa © publications. In Part 3, each participant will have a *full minute* to answer each of the 10 questions of their Quiz, and will have the financial incentive to answer questions correctly.

You will be randomly paired with another participant in the room. We will refer to this participant as your **MATCH.** Your **MATCH** will **not** be taking the same quiz as you (if you are taking Quiz A, your match will be taking Quiz B, and vice-versa). The identity of your **MATCH** will remain constant for the entirety of the Experiment, but their identity will never be revealed to you.

At this time, we will read instructions for Part 1 of the experiment. We will read instructions for the remainder of the experiment *after* you have completed Part 1.

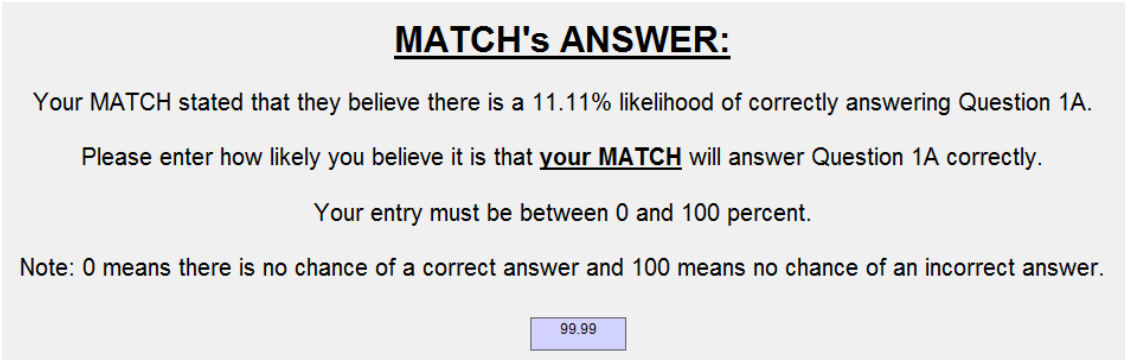
Instructions for Part 1

When Part 1 begins, you will view Question 1 from YOUR quiz (the one that you will take in Part 3) for 15 seconds. After viewing the question, you will be asked to estimate how likely you are to answer this question correctly in Part 3. Recall that, in Part 3, you will have a full minute (60 seconds) to answer the question, and have a financial incentive to do so. You will enter the likelihood in a screen like the one pictured below.



You will have 15 seconds to enter a likelihood, after the first question disappears. After you have entered the likelihood, press the button market "Next", and you will continue to the next question. If you do not enter a likelihood within 15 seconds, the computer will record the likelihood as 0.00%, and you will automatically move on to the next screen.

The 2nd question that you view will be the Question 1 from your **MATCH**'s quiz. After viewing the question for 15 seconds, along with the 5 possible answers, you will be asked to estimate how likely your **MATCH** is to answer this question correctly in Part 3, when he or she will have a full minute (60 seconds) and a financial incentive to do so. You will enter your estimate in a screen like the one pictured below. Your **MATCH** will have previously estimated the likelihood that they will answer they this question correctly. You will be shown your **MATCH**'s estimate, as displayed below.



Again, you will have to enter an estimate for the likelihood within 15 seconds, and to click "Next" to continue. If you do not enter a likelihood and click "Next" within 15 seconds, the computer will record the likelihood as 0.00%, and will automatically move on to the next screen.

The 3rd through 20th questions will proceed in the same manner as the 1st and 2nd. You will alternate between estimating the likelihood that YOU answer your own quiz questions correctly, and the likelihood that your **MATCH** will answer their quiz questions correctly.

After you have completed the process for each of the 20 questions, Part 1 of the experiment is over. At that time, a screen will appear that reads "We are now going to pause to read the next section of the instructions. Please do not touch your computer until instructed to do so." When you reach this screen, please wait patiently for the rest of the participants to finish Part 1. After they have finished, we will proceed with the next portion of the instructions.

Payment for Group 1

As previously stated, each participant has a 1/3 probability of being assigned to Group 1. If you are assigned to Group 1, your payment will be determined as follows:

One of the 20 questions from the two quizzes will be randomly selected as the PAYMENT QUESTION, with each of the questions being equally likely. You will have estimated the likelihood that either you (your quiz) or your **MATCH** (their quiz) will answer this question correctly, in Part 3. This likelihood will be called L^{PQ}.

We will randomly choose a lottery for you, that will give you a some probability of earning $20. If this probability is *less than* the likelihood, L^{PQ}, that you estimated for the payment question, you will be paid if the PAYMENT QUESTION is answered correctly. If this probability is *greater than* L^{PQ}, then you will be paid based on the lottery, with this probability. Thus, accurately estimating each likelihood will maximize the probability that you earn the $20. Specific details are provided below:

The computer will randomly select two numbers, called the THRESHOLD (referred to as T) and the DETERMINANT (referred to as D). Both are equally likely to be any number between 0 and 100.

L^{PQ}, T and D will be used to determine your payment as follows:

- **If $L^{PQ} \geq T$, then D will be used to determine your payment as follows:**
  - **If the PAYMENT QUESTION is from your MATCH's Quiz:**
    - **You will earn $20 if your MATCH answers the PAYMENT QUESTION correctly in Part 3**
    - **You will earn $0 if your MATCH answers the PAYMENT QUESTION incorrectly in Part 3.**

This payment scheme may seem complicated, but what it means for you is simple. You have the highest chance to earn $20 if you estimate each likelihood accurately. The payment scheme has been constructed to ensure that you have the incentive to do so.

Rules

Please do not talk with anyone during the experiment. We ask everyone to remain silent until it is over.

Your participation in the experiment and any information about your earnings will be kept strictly confidential. Your payment's receipt and participant form are the only places in which your name and social security number are recorded.

Once the experimenter instructs you to do so, you may begin with Part 1 of the experiment.

After all participants have finished with Part 1 of the experiment, the Instructor will proceed with the instructions for Part 2.

During Part 1 of the experiment, you may not use a writing instrument of any kind, so please put away all pens and pencils.

We will now continue with the instructions for Parts 2, 3 and 4 of the experiment. There will be no further interruptions in the experiment.

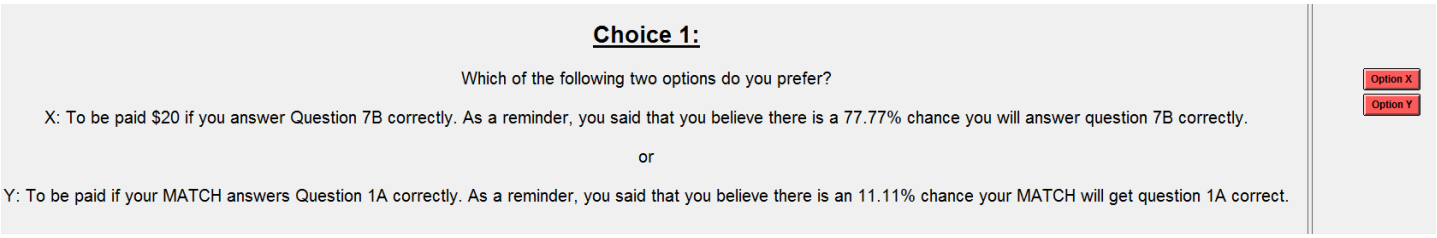
Instructions for Part 2

2

In Part 2, you will face a series of 10 Choices that will determine your payment if you are assigned to Group 2. Each of the 10 Choices will involve 2 of the quiz questions that you viewed in Part 1 of the experiment, 1 from each quiz. Recall that, in Part 1 of the experiment, you estimated the likelihood that you will answer your own quiz questions correctly, and the likelihood that your **MATCH** will answer their quiz questions correctly.

Each of the 10 Choices will ask you to express your preference between two options, Option X and Option Y. Option X pays you $20 if you answer the question from your Quiz correctly, and nothing if you answer it incorrectly. Option Y pays you $20 if your **MATCH** answers the question from their Quiz correctly, and nothing if they answer it incorrectly. Recall that, in Part 3, both you and your match will have 60 seconds to answer each Quiz question.

The 10 Choices will be presented as shown in the graphic below. Note that you will be reminded of the likelihood of a correct answer that you estimated for both yourself and your **MATCH** in Part 1, but not of the question itself.



You should choose Option X if you prefer to be paid $20 only if you answer the first selected question correctly. You should choose Option Y if you prefer to be paid only if your **MATCH** answers the second selected question correctly. You will have 30 seconds to click on either "Option X" or "Option Y". Failure to do so will ensure that you earn nothing from this Choice.

After you have made the 10 Choices in Part 2 of the experiment, you will continue to Part 3, without further interruption. To do so, you will click on the "Begin Part 3" button on the bottom of your computer screen.

Instructions for Part 3

In Part 3 of the experiment, you will answer each of the 10 questions of your Quiz. You will have 1 minute to choose an answer to each question. Unanswered questions will be counted as incorrect.

Instructions for Part 4

After you have answered each question from Part 3 of the experiment, you will have completed all parts of the experiment that can affect your payment. Part 4 is a questionnaire that collects a minimum of demographic data, and asks a few questions about your preferences. You will complete this questionnaire while we arrange your payment.

At the end of Part 3, a screen will appear informing you that a Questionnaire is about to begin. When you click on "Begin Questionnaire", the first question will appear. When you have answered all of the questions, a screen informing you about your payment will begin.

Payment for Group 2

Each participant has a 1/3 probability of being assigned to Group 2. If you are assigned to Group 2, your earnings will be determined as follows:

The computer will randomly select one of the ten Choices from Part 2 of the experiment, with each choice being equally likely. We will refer to this Choice as the PAYMENT CHOICE. Your PAYMENT CHOICE will be used to determine your payment as follows:

- If you choose Option X in the PAYMENT CHOICE:
  - You will earn $20 if you answer the question from YOUR Quiz correctly.
  - You will earn nothing if you do not answer the question from YOUR Quiz correctly.

- If you choose Option Y in the PAYMENT CHOICE:
  - You will earn $20 if your **MATCH** answers the question from their Quiz correctly.
  - You will earn nothing if your **MATCH** does not answer the question from their Quiz correctly.

Payment for Group 3

Each participant has a 1/3 probability of being assigned to Group 3. If you are assigned to Group 3, your earnings will be determined as follows:

The computer will randomly choose one of the 10 questions of your quiz. If you answered this question correctly, you will earn $20. If you answered this question incorrectly, you will earn nothing. It is important that you know that each question is equally likely to be selected, so you should try your best to answer each question correctly.

After everyone has finished with Part 4, we will pass around an answer key for the Quizzes. On the answer key, you will write down the identification number from your computer. When you come to the front of the room you will return the answer key, with the identification number written on it, in exchange for an envelope with your payment in it (in cash). You may not take the answer key with you. When you have received your payment, you may exit the room.

For the remainder of the experiment, you may use a writing instrument and paper, if you wish. You can take them out at this time.

Once the experimenter instructs you to do so, you may begin Part 2 of the experiment.

Appendix B.2.4 Part 1 Instructions for Minimal Ambiguity Condition

Introduction

Thank you for participating in this experiment. Please follow along carefully as the experimenter reads through these instructions. If you have any questions, please do not hesitate to raise your hand.

This is an experiment in the economics of decision-making. A research foundation has provided funds for conducting this research.

For your participation, you will be paid privately and in cash at the end of this session. Your earnings will depend partly on your decisions, partly on the decisions of others, and partly on chance. If you follow the instructions and make careful decisions, you increase your chance of earning more money.

You will receive $10 as a participation fee (simply for showing up on time and completing the experiment). Details of how you will make decisions and gain subsequent earnings are provided below.

Five-part experiment

The experiment has 5 parts, Part 1, Part 2, Part 3, Part 4 and Part 5. Part 5 is a questionnaire that we ask you to complete while we arrange your payment. Your answers in Part 5 will not affect your payment in any way.

To determine further earnings (beyond the $10 participation fee), you will be randomly assigned to one of 4 Groups. You are equally likely to be assigned to Group 1, Group 2, Group 3 and Group 4. If you are assigned to Group 1, your earnings will be determined by Part 1 of the experiment. If you are assigned to Group 2, your earnings will be determined by Part 2, and if you are assigned to Group 3 or 4, they will be determined by Part 3 or 4, respectively. You will learn which group you have been assigned to at the END of the experimental session.

Instructions for Part 1

At this time, we will read instructions for Part 1 of the experiment. We will read instructions for the remainder of the experiment *after* you have completed Part 1. When the experimenter tells you to do so, you will click the **Begin Part 1** button located at the bottom of your computer screen.

Part 1 of this experiment is a 10 question quiz. The questions to the Quiz are all multiple-choice with 5 possible answers, and most are logic or mathematics puzzles drawn from Mensa © publications. You will have a full minute (60 seconds) to answer each question.

Payment for Group 1

As previously stated, each participant has a 25% chance of being assigned to Group 1. If you are assigned to Group 1, your payment will be determined as follows:

One of the 10 questions from quiz will be randomly selected, with each of the questions being equally likely. If you answer this question correctly, you will earn $20. If you answer this question incorrectly, you will earn $0.

Rules

Please do not talk with anyone during the experiment. We ask everyone to remain silent until it is over.

Your participation in the experiment and any information about your earnings will be kept strictly confidential. Your payment's receipt and participant form are the only places in which your name and social security number are recorded.

Once the experimenter instructs you to do so, you may begin with Part 1 of the experiment.

After all participants have finished with Part 1 of the experiment, the Instructor will proceed with the instructions for Part 2.

During Part 1 of the experiment, you may use a writing instrument and paper.

Appendix B.2.5 Part 2 Instructions for Minimal Ambiguity Condition

Overview

This remainder of this experiment consists of two quizzes similar to the one in part 1, Quiz A and Quiz B. The questions of Quiz A are labeled 1A, 2A, 3A....10A, and the questions of Quiz B are labeled 1B, 2B, 3B...10B. In Part 4 of the experiment, you will take ONE of the two Quizzes. Roughly half of the participants in the room will take each quiz. In Part 3, each participant will have again a full minute to answer each of the 10 questions of their Quiz, and will have the financial incentive to answer questions correctly.

You will now be randomly paired with another participant in the room. We will refer to this participant as your **MATCH.** Your **MATCH** will **not** be taking the same quiz as you (if you are taking Quiz A, your match will be taking Quiz B, and vice-versa). The identity of your **MATCH** will remain constant for the entirety of the Experiment, but their identity will never be revealed to you.

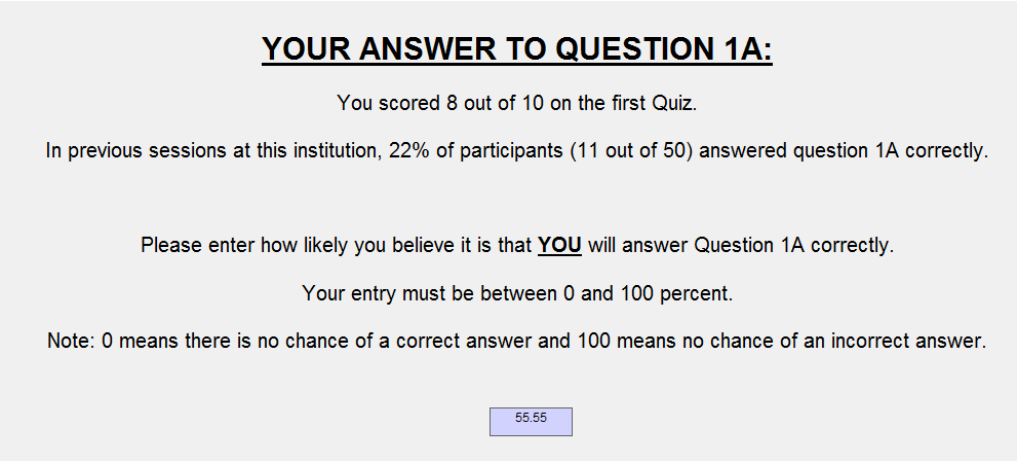
Instructions for Part 2

When the experimenter tells you to do so, you will click the **Begin Part 2** button located at the bottom of your computer screen.

When Part 2 begins, you will view Question 1 from YOUR quiz (the one that you will take in Part 4) for 15 seconds. After viewing the question, you will be asked to estimate how likely you are to answer this question correctly in Part 4. When you estimate this likelihood, you will be shown the following information:

1. The number of questions that you answered correctly on the first quiz.
2. The proportion of participants that answered this question correctly in previous sessions in this facility.

Recall that, in Part 4, you will have a full minute (60 seconds) to answer the question, and have a financial incentive to do so. You will enter the likelihood in a screen like the one pictured below.

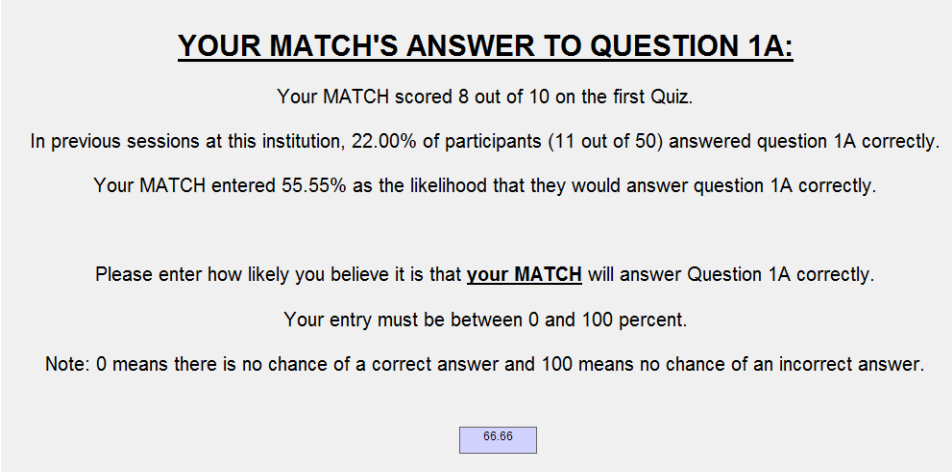


You will have 25 seconds to enter a likelihood, after the first question disappears. After you have entered the likelihood, press the button market "Next", and you will continue to the next question. If you do not enter a likelihood within 25 seconds, the computer will record the likelihood as 0.00%, and you will automatically move on to the next screen.

The 2nd question that you view will be the Question 1 from your **MATCH**'s quiz. After viewing the question for 15 seconds, along with the 5 possible answers, you will be asked to estimate how likely your **MATCH** is to answer this question correctly in Part 4, when they will have a full minute (60 seconds) and a financial incentive to do so. You

will enter your estimate in a screen like the one pictured below. When you estimate this likelihood, you will be shown the following information:

1. The number of questions that your **MATCH** answered correctly on the first quiz.
2. The proportion of participants that answered this question correctly, at this facility, in previous sessions.
3. The likelihood that your **MATCH** just estimated for their own correct answer.



Again, you will have to enter an estimate for the likelihood within 25 seconds, and to click "Next" to continue. If you do not enter a likelihood and click "Next" within 25 seconds, the computer will record the likelihood as 0.00%, and will automatically move on to the next screen.

The 3rd through 20th questions will proceed in the same manner as the 1st and 2nd. You will alternate between estimating the likelihood that YOU answer your own quiz questions correctly, and the likelihood that your **MATCH** will answer their quiz questions correctly.

After you have completed the process for each of the 20 questions, Part 2 of the experiment is over. At that time, a screen will appear that reads "We are now going to pause to read the next section of the instructions. Please do not touch your computer until instructed to do so." When you reach this screen, please wait patiently for the rest of the participants to finish Part 2. After they have finished, we will proceed with the next portion of the instructions.

Payment for Group 2

As previously stated, each participant has a 25% of being assigned to Group 2. If you are assigned to Group 2, your payment will be determined as follows:

One of the 20 questions from the two quizzes will be randomly selected as the PAYMENT QUESTION, with each of the questions being equally likely. You will have estimated the likelihood that either you (your quiz) or your **MATCH** (their quiz) will answer this question correctly, in Part 4. This likelihood will be called L^{PQ}.

We will randomly choose a lottery for you, that will give you a some probability of earning $20. If this probability is *less than* the likelihood, L^{PQ}, that you estimated for the payment question, you will be paid if the PAYMENT QUESTION is answered correctly. If this probability is *greater than* L^{PQ}, then you will be paid based on the lottery, with this probability. Thus, accurately estimating each likelihood will maximize the probability that you earn the $20. Specific details are provided below:

The computer will randomly select two numbers, called the THRESHOLD (referred to as T) and the DETERMINANT (referred to as *D*). Both are equally likely to be any number between 0 and 100.

L^{PQ}, *T* and *D* will be used to determine your payment as follows:

- **If $L^{PQ}<T$, *T* and *D* will be used to determine your payment as follows*:***
  - **You will earn $20 if $T \geq D$.**
  - **You will earn $0 if $T<D$.**

- **If $L^{PQ} \geq T$, the given answer to the PAYMENT QUESTION will determine your payment as follows*:***
  - **If the PAYMENT QUESTION is from YOUR Quiz:**
    - **You will earn $20 if you answer the PAYMENT QUESTION correctly in Part 4.**
    - **You will earn $0 if you answer the PAYMENT QUESTION incorrectly in Part 4.**
  - **If the PAYMENT QUESTION is from your MATCH's Quiz:**
    - **You will earn $20 if your MATCH answers the PAYMENT QUESTION correctly in Part 4.**
    - **You will earn $0 if your MATCH answers the PAYMENT QUESTION incorrectly in Part 4.**

This payment scheme may seem complicated, but what it means for you is simple. You have the highest chance to earn $20 if you estimate each likelihood accurately. The payment scheme has been constructed to ensure that you have the incentive to do so.

Rules

Please do not talk with anyone during the experiment. We ask everyone to remain silent until it is over.

Your participation in the experiment and any information about your earnings will be kept strictly confidential. Your payment's receipt and participant form are the only places in which your name and social security number are recorded.

Once the experimenter instructs you to do so, you may begin with Part 2 of the experiment.

After all participants have finished with Part 2 of the experiment, the Instructor will proceed with the instructions for Part 3.

During Part 2 of the experiment, you may not use a writing instrument of any kind, so please put away all pens and pencils.

Appendix B.2.6 Parts 3-5 Instructions for Minimal Ambiguity Condition

We will now continue with the instructions for Parts 3, 4 and 5 of the experiment. There will be no further interruptions in the experiment.

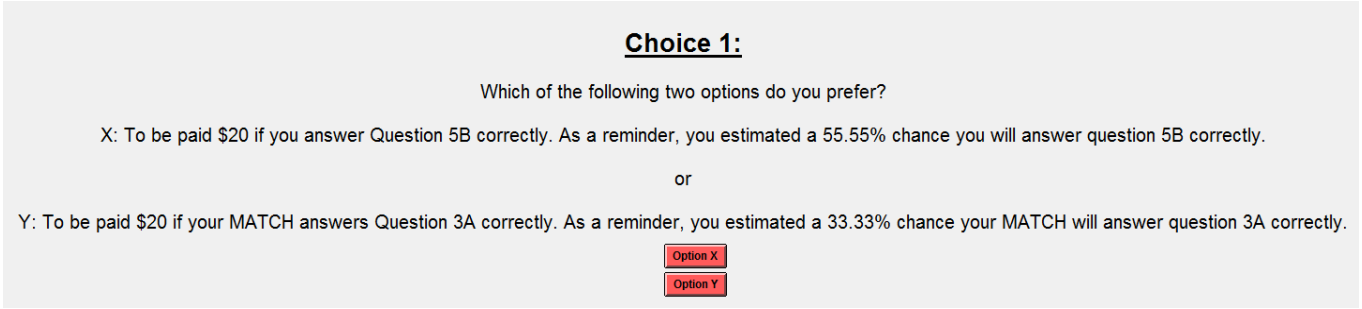
Instructions for Part 3

When the experimenter tells you to do so, you will click the **Begin Part 3** button located at the bottom of your computer screen.

In Part 3, you will face a series of 10 Choices that will determine your payment if you are assigned to Group 3. Each of the 10 Choices will involve 2 of the quiz questions that you viewed in Part 2 of the experiment, 1 from each quiz. Recall that, in Part 2 of the experiment, you estimated the likelihood that you will answer your own quiz questions correctly, and the likelihood that your **MATCH** will answer their quiz questions correctly.

Each of the 10 Choices will ask you to express your preference between two options, Option X and Option Y. Option X pays you $20 if you answer the question from your Quiz correctly, and nothing if you answer it incorrectly. Option Y pays you $20 if your **MATCH** answers the question from their Quiz correctly, and nothing if they answer it incorrectly. Recall that, in Part 4, both you and your match will have 60 seconds to answer each Quiz question.

The 10 Choices will be presented as shown in the graphic below. Note that you will be reminded of the likelihood of a correct answer that you estimated for both yourself and your **MATCH** in Part 2, but not of the question itself, nor of the other information that you had when you estimated the likelihood.



You should choose Option X if you prefer to be paid $20 only if you answer the first selected question correctly. You should choose Option Y if you prefer to be paid only if your **MATCH** answers the second selected question correctly. You will have 30 seconds to click on either "Option X" or "Option Y". Failure to do so will ensure that you earn nothing from this Choice.

After you have made the 10 Choices in Part 3 of the experiment, you will continue to Part 4, without further interruption. To do so, you will click on the "Begin Part 4" button on the bottom of your computer screen.

Instructions for Part 4

In Part 4 of the experiment, you will answer each of the 10 questions of your Quiz. You will have 1 minute to choose an answer to each question. Unanswered questions will be counted as incorrect.

Instructions for Part 5

After you have answered each question from Part 4 of the experiment, you will have completed all parts of the experiment that can affect your payment. Part 5 is a questionnaire that collects a minimum of demographic data,

and asks a few questions about your preferences. You will complete this questionnaire while we arrange your payment.

At the end of Part 4, a screen will appear informing you that a Questionnaire is about to begin. When you click on "Begin Questionnaire", the first question will appear. When you have answered all of the questions, a screen informing you about your payment will begin.

Payment for Group 3

Each participant has a 25% of being assigned to Group 3. If you are assigned to Group 3, your earnings will be determined as follows:

The computer will randomly select one of the ten Choices from Part 3 of the experiment, with each choice being equally likely. We will refer to this Choice as the PAYMENT CHOICE. Your PAYMENT CHOICE will be used to determine your payment as follows:

- If you choose Option X in the PAYMENT CHOICE:
  - You will earn $20 if you answer the question from YOUR Quiz correctly.
  - You will earn nothing if you do not answer the question from YOUR Quiz correctly.

- If you choose Option Y in the PAYMENT CHOICE:
  - You will earn $20 if your **MATCH** answers the question from their Quiz correctly.
  - You will earn nothing if your **MATCH** does not answer the question from their Quiz correctly.

Payment for Group 4

Each participant has a 25% of being assigned to Group 4. If you are assigned to Group 4, your earnings will be determined as follows:

The computer will randomly choose one of the 10 questions of your quiz. If you answered this question correctly, you will earn $20. If you answered this question incorrectly, you will earn nothing. It is important that you know that each question is equally likely to be selected, so you should try your best to answer each question correctly.

After everyone has finished with Part 5, we will pass around an answer key for the Quizzes. On the answer key, you will write down the identification number from your computer. When you come to the front of the room you will return the answer key, with the identification number written on it, in exchange for an envelope with your payment in it (in cash). You may not take the answer key with you. When you have received your payment, you may exit the room.

For the remainder of the experiment, you may use a writing instrument and paper, if you wish. You can take them out at this time.

Once the experimenter instructs you to do so, you may begin Part 3 of the experiment.

Appendix B.2.7 Instructions for No Probability Condition

Introduction

Thank you for participating in this experiment. Please follow along carefully as the experimenter reads through these instructions. If you have any questions, please do not hesitate to raise your hand.

This is an experiment in the economics of decision-making. A research foundation has provided funds for conducting this research.

For your participation, you will be paid privately and in cash at the end of this session. Your earnings will depend partly on your decisions, partly on the decisions of others, and partly on chance. If you follow the instructions and make careful decisions, you increase your chance of earning more money.

You will receive $10 as a participation fee (simply for showing up on time). Details of how you will make decisions and gain subsequent earnings are provided below.

Three-part experiment

The experiment has three parts, Part 1, Part 2, and Part 3. Part 3 is a questionnaire that we ask you to complete while we arrange your payment. Your answers in Part 3 will not affect your payment in any way.

To determine further earnings (beyond the $10 participation fee), you will be randomly assigned to one of 2 Groups. You are equally likely to be assigned to Group 1 or Group 2. If you are assigned to Group 1, your earnings will be determined by Part 1 of the experiment. If you are assigned to Group 2, your earnings will be determined by Part 2.

Overview

This experiment consists of two separate 10 question quizzes, Quiz A and Quiz B. The questions of Quiz A are labeled 1A, 2A, 3A....15A, and the questions of Quiz B are labeled 1B, 2B, 3B...15B. In Part 2 of the experiment, you will take ONE of the two Quizzes. Roughly half of the participants in the room will take each quiz. The questions to each Quiz are all multiple-choice with 5 possible answers, and most are logic or mathematics puzzles drawn from Mensa © publications. In Part 2, each participant will have a *full minute* to answer each of the 15 questions of their Quiz, and will have the financial incentive to answer questions correctly.

You will be randomly paired with another participant in the room. We will refer to this participant as your **MATCH.** Your **MATCH** will **not** be taking the same quiz as you (if you are taking Quiz A, your match will be taking Quiz B, and vice-versa). The identity of your **MATCH** will remain constant for the entirety of the Experiment, but their identity will never be revealed to you.

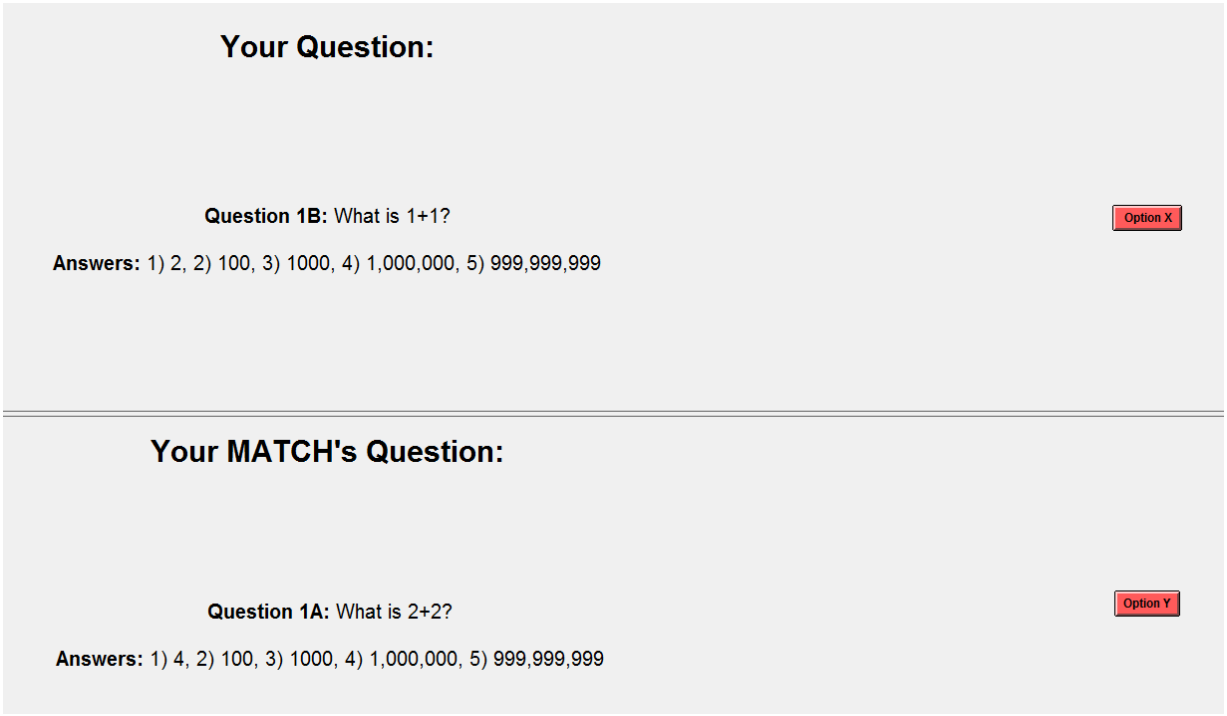
At this time, we will read detailed instructions for the experiment.

Instructions for Part 1

When the experimenter tells you to do so, you will click the **Begin Part 1** button located at the bottom of your computer screen.

In Part 1, you will face a series of 15 Choices that will determine your payment *if you are assigned to Group 1*. When Part 1 begins, a screen will appear showing 2 quiz questions: Question 1 from YOUR quiz (the one that you will take in Part 2) and Question 1 from your **MATCH's** quiz (the one that your **MATCH** will take in Part 2). The

questions will appear on your screen for a total of 30 seconds. Your choice will be between two options: Option X and Option Y. Option X pays you $20 if you answer question 1 from your Quiz correctly, and nothing if you answer it incorrectly. Option Y pays you $20 if your **MATCH** answers question 1 from their Quiz correctly, and nothing if they answer it incorrectly. Recall that, in Part 2, both you and your match will have a full minute (60 seconds) to answer your respective questions. The screen that appears will be similar to the one pictured below:



You should choose Option X if you prefer to be paid $20 only if you answer the first selected question correctly. You should choose Option Y if you prefer to be paid only if your **MATCH** answers the second selected question correctly. You will have 30 seconds to click on either "Option X" or "Option Y". Failure to do so will ensure that you earn nothing from this Choice.

After you have made the 15 Choices in Part 1 of the experiment, you will continue to Part 2, without further interruption. To do so, you will click on the "Begin Part 2" button on the bottom of your computer screen.

Payment for Group 1

Each participant has a 50% probability of being assigned to Group 1. If you are assigned to Group 1, your earnings will be determined as follows:

The computer will randomly select one of the 15 Choices from Part 1 of the experiment, with each choice being equally likely. We will refer to this Choice as the PAYMENT CHOICE. Your PAYMENT CHOICE will be used to determine your payment as follows:

- If you choose Option X in the PAYMENT CHOICE:
  - You will earn $20 if you answer the question from YOUR Quiz correctly.
  - You will earn nothing if you do not answer the question from YOUR Quiz correctly.

- If you choose Option Y in the PAYMENT CHOICE:

- You will earn $20 if your **MATCH** answers the question from their Quiz correctly.
- You will earn nothing if your **MATCH** does not answer the question from their Quiz correctly.

Instructions for Part 2

In Part 2 of the experiment, you will answer each of the 15 questions of your Quiz (which you viewed in part 1). You will have 1 minute to choose an answer to each question. Unanswered questions will be counted as incorrect.

Payment for Group 2

Each participant has a 50% probability of being assigned to Group 3. If you are assigned to Group 3, your earnings will be determined as follows:

The computer will randomly choose one of the 15 questions of your quiz. If you answered this question correctly, you will earn $20. If you answered this question incorrectly, you will earn nothing. It is important that you know that each question is equally likely to be selected, so you should try your best to answer each question correctly.

Instructions for Part 3

After you have answered each question from Part 2, you will have completed the parts of the experiment that can affect your payment. Part 3 is a questionnaire that collects a minimum of demographic data, and asks a few questions about your preferences. You will complete this questionnaire while we arrange your payment.

At the end of Part 3, a screen will appear informing you that a Questionnaire is about to begin. When you click on "Begin Questionnaire", the first question will appear. When you have answered all of the questions, a screen informing you about your payment will begin.

Rules

Please do not talk with anyone during the experiment. We ask everyone to remain silent until it is over.

Your participation in the experiment and any information about your earnings will be kept strictly confidential. Your payment's receipt and participant form are the only places in which your name and social security number are recorded.

Once the experimenter instructs you to do so, you may begin with Part 1 of the experiment. During Part 1 of the experiment, you may not use a writing instrument of any kind, so please put away all pens and pencils. After all participants have finished with Part 1 of the experiment, the Instructor will tell you when you may proceed to Part 2. You may use a writing instrument during Part 2. Please turn in any paper that you have used to the Instructor at the end of the experimental session.