DO WE TALK TOO MUCH?

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Abstract. We consider the trade-off between talking and listening in a laboratory experiment where two team members need to coordinate on the use of an information channel. Each team member indicates their preference to "talk" and share her own information with her teammate, or to "listen" and obtain knowledge of the teammate's information. The nature of the information varies across treatments. For stylized urns-and-balls treatments, we formalize a version of the "hard-easy effect" of over- and under-confidence: players talk more in situations where information is relatively precise – not only for the talker but also for the listener. Indeed we find that a more precise information structure induces a higher talking frequency, with a difference of 5 percentage points, relative to a baseline of 48 percent. The game-theoretic equilibrium, with rational expectations, predicts no such treatment effect. In treatments where information arises from real-world contexts, the hard-easy effect on the talking frequency is even stronger, at about 13 percentage points, relative to a baseline of about 38 percent.

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1. Introduction

For most economic activities, the acquisition and dissemination of information is endogenous to the activity at hand. The amounts of demanded and supplied information depend on how much the demanders and suppliers stand to gain from the exchange. One aspect of this endogeneity is that demand and supply may be in direct competition with each other: for attention, time and other resources. Any scientific conference, administrative committee, or business meeting is limited, such that a person who manages to take air time in the meeting will make it less likely that others have air time, too. Seeking air time for oneself, therefore, makes it less likely that one listens to others, and the person's decision to seek air time needs to take this trade-off into account.

In this paper, we present a game that highlights the trade-off between talking and listening, viewed from an informational perspective: how to use a communication channel for a maximally efficient change in beliefs. Behavior in this game indicates the extent to which the interlocutors – the people in the conversation – misperceive the trade-off, talking too much or too little. The measurement occurs in a stylized experiment, necessarily leaving out many motives other than informational ones.[1] Yet, our experimental variations help isolate conditions under which biased beliefs about the trade-off induce a higher or lower talking frequency.

A strong intuition comes from the "hard-easy effect" on relative overconfidence: when people find a task easier, they forget that it is also easier for others (Moore and Healy, 2008). The interlocutors may over-place themselves in terms of talking ability and talk more when the topic of conversation is easy than when it is hard.[2] A potential caveat is that people may also over-place themselves in their listening ability, which may counteract the effect. We use a simple communication game that enables a clear prediction, by varying "hard" versus "easy" in terms of the players' information precision. Each player receives a signal from a common signal structure, the precision of which varies across treatments, such that a player's possible under-appreciation of the fact that the other player has the same signal precision would generate an unambiguous tendency to talk more in treatments with higher precision than in those with lower precision.

The players' motivation to talk versus listen comes from the inclusion of a subsequent guessing stage, after the information exchange, where one of the players is randomly chosen to speak for the team and to report a belief about the state of the world, in a way that is payoff relevant for both players. Incentives are, thus, fully aligned and the players' optimal strategies have the intuitive property that for a wide set of beliefs, a player talks

[1] See, for instance Hirschi et al. (2023) for a discussion of the effect of trying to appear likable or interesting on the propensity to say something. More generally, a large literature described motives of self-disclosure in conversations, summarized e.g. in Chapter 9 of Hargie (2017). A survey of belief distortions in communication games is in Weizsäcker (2023).

[2] Subjective confidence comes in many versions and has shown to have extensive impact in economics behaviors (e.g., Malmendier and Tate (2005); Murphy and Weinhardt (2020)) but our focus is strictly on over-placement, i.e. one's assessment about oneself relative to others. This version of overconfidence, too, has been found to be relevant in numerous economic choices (see e.g. Cain et al. (2015)) but we are not aware of applications to the choice between talking and listening. Grabova (2023) describes a related game where two potentially overconfident talkers compete for the role of talking to the receiver.

if and only if she feels better informed than the other player. This property corresponds to a basic principle in linguistics and philosophy of language, the "implicit guarantee of relevance" (Sperber and Wilson, 1995) and our game highlights the mechanism for this principle: it is strictly optimal to make the worse-informed player listen and receive the maximal information because the team's payoff increase is larger if the worse-informed player improves her information than if the better-informed player does so.[3]

Across sets of treatments, we also vary the nature of the players' information. Our *abstract* experiments involve a probabilistic signal structure with state-dependent signal probabilities that are commonly known among the players. Specifically, the state space is binary (i.e., {0,1}), with states equally likely ex-ante, but the signal space is continuous (i.e., [0,1]). Our setting makes it fully evident to each player how much she knows about the state of the world: the closer the signal is to 1 (0) the more likely it is that the state is 1 (0). The message space is stylized, too: the messages are identical to the signals that the players receive, such that a player's choice amounts to passing the signal on to the other player ("talk"), or receiving the other's signal ("listen"): only one of the two signals can be transmitted among the players.[4]

The advantage of the abstract treatments is that we can derive the predictions of Perfect Bayesian Nash Equilibrium and of the hard-easy effect. Specifically, across treatments we reduce the ex-ante signal precision. This means that, for example, in the *hard* treatment a signal realization close to 1 is less likely to indicate that the state is 1 relative to the *easy* treatment. The predictions for this game can be expressed in terms of the critical signal value, at which the player is indifferent between talking and listening. For signals between 0.5 and the critical signal value, the player prefers to see the other's signal, while for values beyond the critical value, the player prefers to share her signal with the other. A key observation is that in equilibrium, the critical value stays the same when moving from the easy treatment to the hard treatment. The reason is symmetry: regardless of their precision, signals are ex-ante equally informative to both players. However, the hard-easy effect predicts that the behavior will respond to signal precision, i.e., that there is more talking in the easy treatment.

The second type of experiments, *context*, is motivated by the same question but brings the environment closer to real-world communication. Participants are presented with a trivia question on a naturally-occurring event and two possible answers, with the correct answer appearing as the first or second answer with ex-ante equal likelihood. After reading the question and the possible answers, each player writes a natural-language message about the event. One such message is chosen to be sent from one player to the other, according to the players' choices – just like signals are sent in the *abstract* game – and one randomly chosen player then reports her belief about the correct answer being the first-listed one. The task is effectively a quiz task, where the team solves the quiz jointly and

[3]In many real-life conversations, but not in our game, the implicit guarantee of relevance also has an important consequences for a listener's inference. She can learn about the state of the world from the fact that the other player decides to talk or to listen. Our game avoids this effect.

[4]As the next section will elaborate, the two players' choice is implemented if both players agree on whose message is to be sent; otherwise, a random draw determines whose signal is sent.

exchanges one message.[5] Apart from identity of states and signals/messages, the protocol of the *context* game is identical to that of the *abstract* game, and the experimental context treatments therefore also enable a measurement of the heard-easy effect: we manipulate the difficulty of the quiz via different wordings of the quiz question, leaving all other elements of the quiz constant.[6]

The results show that our hard-easy manipulations indeed change the frequencies of talking in the hypothesized direction. In the abstract environments, participants talk more in easy treatments than in hard treatments, with a difference of five percentage points, relative to a baseline of 48 percent. Correspondingly, their critical signal value for being willing to talk is less stringent in easy than in hard, by 0.48 of a standard deviation, significantly rejecting the equilibrium prediction. Across both treatments of the abstract setting, the observed strategies are, however, fairly well calibrated, and payoff losses due to avoidable reductions in guessing precision are relatively small.

In context treatments, where talking is a natural-language act, the hard-easy effect on the talking frequency is larger. It is noteworthy that the deviation from optimal talking appears mostly in the hard context treatment, where only 38 percent of participants decide to talk on average, yielding a mis-coordination of talking decisions overall. Moving from hard to easy context treatments increases the talking frequencies by 13 percentage points.

Finally, we check whether talking is too frequent overall. Here, the picture is more differentiated. In the abstract treatments, we can exploit that in a subset of tasks, the talking/listening decision was exogeneously imposed on the participants. This allows to estimate the empirical incentives to talk: we can compare how precise their guesses are in situations where they were forced to listen versus where they were forced to talk. Moreover, we can estimate this difference in their guesses' precision conditional on the value of their signals. We find that in cases where signal values are such that listening is only marginally better, talking is in fact too frequent, whereas the converse is not true in cases where talking is marginally better. In the context treatments, the frequency of talking is overall small. But even in these treatments, being forced to listen yields lower average payments than if participants can choose freely whether or not they want to talk or listen. Overall, while the experiment cannot provide a general statement that applies to other situations, we answer the question in the paper's title negatively for the present sample: the participants do not talk too much. Our experiment identifies conditions where interlocutors talk relatively more than in others, but they are fairly accurate in their talking strategies.

The next two sections present the design of our experiments in detail. Section 4 presents the results, and Section 5 concludes.

[5]Notice, however, that our design separates the use of natural language – the act of writing of the message – from the decision to talk or to listen.

[6]General-knowledge quizzes and IQ test are often used in experimental economics, e.g. to create feelings of entitlements (Hoffman et al., 1994) but they are also useful to create separations of more or less capable participants (Burks et al., 2013; Grabova, 2023).

2. Abstract Environment

We first present the abstract game and its predictions, and subsequently describe the abstract game's experimental implementation in the laboratory. The implementation of the context treatments appears in Section 3.

2.1. **Game.** There is a binary state of the world, $\omega \in \{0,1\}$, where each state is equally likely. Two players ($i = 1,2$) do not observe ω but they separately and simultaneously receive independent and identically distributed signals s_1 and s_2, where $s_i \in [0,1]$ and the state-dependent densities of signal s_i are

$$f(s_i,\omega) = \begin{cases} 1-\tau_i(2s_i-1) & \text{if } \omega = 0 \\ 1+\tau_i(2s_i-1) & \text{if } \omega = 1 \end{cases},$$

with corresponding CDFs $F(s_i,\omega)$. With these densities, larger (smaller) values of s_i imply a higher (lower) ex-post belief in state $\omega = 1$. Notice that $\tau_i \in [0,1]$ is a parameter that affects the precision of the signal. It is straightforward to verify that the higher τ_i is, the more precise the signal is.

After observing her private signal s_i, each player makes a first choice as to whether they would like to talk or listen. That is, she chooses $a_i \in A = \{\text{talk, listen}\}$.

The issue of who gets to talk or listen is settled after another random move by nature: With probability 1/2, the action a_l of player l (where $l \in \{1,2\}$) is implemented. Implementing the randomly selected action a_l means that player l sees the other player's signal (s_{-l}) if a_l = listen and player $-l$ sees s_l if a_l = talk.[7] Thus, after the randomly selected action is implemented, one player will have observed two signals (their own and the other's) and the other player will have observed only their own signal.

Subsequently, each player reports her belief that the state is $\omega = 1$. The payoff relevance of the player's reports $\{p_i\}_{i\in\{1,2\}}$ is, once again, determined by a random draw. Nature selects one of the two belief reports to determine the payoffs to *both* players. With probability 1/2, player k's belief p_k is used to determine payoffs, where $k \in \{1,2\}$. Payoffs are given by the binarized scoring rule. The rule is incentive compatible in that it yields, for a report p_k and a true (subjective) belief q that player k may hold, the expected payoff

$$\pi(q,p_k) = q\left(1-(1-p_k)^2\right) + (1-q)\left(1-p_k^2\right),$$

which is maximized at $p_k = q$. The incentive compatibility is irrespective of risk attitudes, as the rule pays a prize of \$$X$ with probability $\left(1-(1-p_k)^2\right)$ if $\omega = 1$, and the same prize with probability $\left(1-p_k^2\right)$ if $\omega = 0$.

[7] The outcome of the move by nature is observed by the players. So, for example, if nature selects action a_l and player l chose to listen, player $-l$ will not observe another signal, but will know that the other selected to listen.

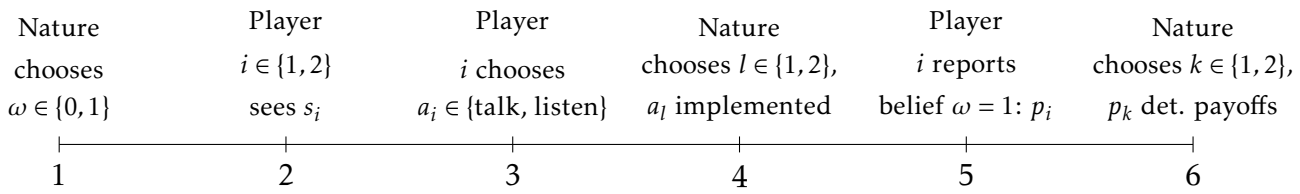

FIGURE 1. Timing of the Game

The following list summarizes of the timing of the game, which is also condensed in Figure 1.

(1) Nature chooses $\omega \in \{0,1\}$ with equal probability.

(2) Nature draws two iid signals s_1 and s_2, conditional on ω, and s_i is shown to player $i \in \{1,2\}$.

(3) Simultaneously, players choose $a_i \in A =$ {talk, listen}.

(4) With equal probability, one player $l \in \{1,2\}$ is selected and her choice a_l is implemented. Player l sees s_{-l} if $a_l =$ talk. Player $-l$ sees s_l if $a_l =$ listen.

(5) Simultaneously, players report their beliefs p_i that $\omega = 1$.

(6) With equal probability, one player $k \in \{1,2\}$ is selected and her belief p_k determines the payoff to both players.

Equilibria. The central result of this section characterizes for which signal values a player wants to share her signal with the other (talk) versus preferring to see the other's signal (listen). Before describing equilibrium behavior, we notice that the binarized scoring rule makes it optimal to reveal truthful belief reports (Hossain and Okui, 2013). In equilibrium, each player therefore submits a belief report that incorporates all information that the player has available, and both players aim to make each other optimally informed via the choices in the game's earlier stages. To achieve that players are optimally informed, the players follow a simple and intuitive rule in their decisions to talk/listen:

Player i talks if and only if her signal value s_i indicates to her that she is, in expectation, better informed than player $-i$, i.e., that s_{-i} is likely less precise about ω.

To see that this is optimal, we differentiate two cases. First, consider the case that player k, the randomly chosen player whose report is payoff relevant, is the listener. Since k knows both signal values s_i and s_{-i} in this case, it does not matter whether k is equal to i or not. A trade-off between talking and listening emerges only in the other case, namely that the belief-reporting player k is the player who has only one signal available (i.e., the player who talks). In this case, it is important that this player is maximally informed. Player i's contribution to this is to maximize the probability that the player with the more precise signal sends his or her signal. That is, i talks if she expects to be the better informed player.

This rule also implies that without loss of generality, we can constrain attention to cutoff strategies, with a cutoff $c \in [1/2, 1]$: if a signal value induces a player to talk, then it must also be true that all more extreme signal values induce the player to talk. If player i's signal is above c or below $1-c$, it is deemed informative enough and the player would rather that the other player observed s_i.[8] On the other hand, if her signal is relatively uninformative and falls within $[1-c, c]$, then the player would rather observe the other's signal. The following result shows that in the unique equilibrium prediction, the threshold for player i depends on the ratio $\frac{\tau_{-i}}{\tau_i}$, capturing the informativeness of the other player's signal distribution relative to i's own.

Result 1. *There is a unique Perfect-Bayes-Nash cutoff equilibrium, where player $i \in \{1, 2\}$ selects to listen if $s_i \in [1 - c_i^\star, c_i^\star]$, and to talk otherwise. The cutoff is determined by:*

$$c_i^\star = \begin{cases} \frac{1}{2} + \frac{\sqrt{3}}{6}\frac{\tau_{-i}}{\tau_i} & \text{if } \frac{1}{2} + \frac{\sqrt{3}}{6}\frac{\tau_{-i}}{\tau_i} \leq 1 \\ 1 & \text{otherwise.} \end{cases}$$

Proof. See Appendix A. □

The equilibrium cutoff only depends on τ_{-i}/τ_i, the ratio of relative informativeness of the signals. To understand the effect of varying this ratio, consider first the extreme case that τ_{-i}/τ_i approaches zero, i.e., the informativeness of i's signal is overwhelming relative to that of $-i$'s. In this case, both players' beliefs can improve exclusively by observing s_i. Consequently, the threshold approaches $1/2$, meaning that i will talk (share her signal) for any signal value. As τ_{-i}/τ_i increases, the value of the other's signal relative to i's increases and a listening interval appears. The size of the interval increases in τ_{-i}/τ_i and it eventually hits the upper bound – the other extreme case – where $c_i^\star = 1$. This case corresponds to the constellation where s_{-i} is extremely informative relative to s_i, so that i wants to listen for any signal value that she may observe.

While the result's proof is in Appendix A, we give a short sketch here. As we described in the paragraphs before the statement of the result, the decisive bit in the trade-off between talking and listening is the consideration of the case where the least informed person is person k, i.e., the least informed person's belief is selected to determine payoffs. In this hypothetical case, the benefit from talking is increasing in s_i whenever $s_i \in (1/2, 1)$:[9] when s_i is relatively close to $1/2$, the least informed person is more likely to be i and when s_i is relatively close to 1, the least informed person is less likely to be i. On the other hand, the expected benefit that player i obtains from listening is constant in s_i. The reason is that when i makes a decision, she can only compute an expected benefit of learning $-i$'s

[8] Notice that the cutoff is symmetric in the sense that the distance from the lower cutoff $(1-c)$ to 0 is the same as the distance from the upper cutoff c to 1. This symmetry responds to the fact that states are equally likely ex-ante so that states could be relabeled with no consequence.

[9] Specifically, it takes the following form: $3/4 + (1/4)\tau_i^2 - \tau_i^2 s_i + \tau_i^2 s_i^2$. See Appendix A for further details.

signal, and this expected benefit of listening depends only on τ_{-i}.[10] The cutoff is the signal value such these two benefits of talking vs. listening are equal.

A special case that we will use in our experimental design is where $\tau_i = \tau_{-i} = \tau$ so that both signal structures are equally informative. In this case, $c^\star \approx 0.79$. The probability of talking for player i is the chance that $s_i \in [0, 0.21) \cup (0.79, 1]$, which is approximately 42 percent. This means that the likelihood of talking is the same if densities for both players are the same and relatively informative (high τ), or if both signals are the same and relatively uninformative (low τ).

The result also indicates the "behavioral" bias that palyers may suffer from if they are subject to the hard-easy effect. If a player does not incorporate, or only partially incorporates, that the other player has the same precision of information, one would expect that her cutoff behaves in analogy to her subjectively perceived ratio of signal precisions, and otherwise follows Result 1. We outline this as a hypothesis for the experiment:

Hypothesis 1. *Between two cases where $\tau_i = \tau_{-i} = \tau$ and $\tau_i' = \tau_{-i}' = \tau'$, where $\tau > \tau'$, we expect to observe a lower cutoff (more talking) for the first case where the signals are more informative, in contradiction to the equilibrium prediction of no change in cutoffs between the two cases.*

2.2. **Experimental Design.** An experimental session consists of 30 periods, where in each period participants are randomly matched in pairs. We start the instructions by providing them with the timing in a given period, which we describe in five steps. The first step corresponds to nature selecting the state of the world, presented as the toss of a fair coin. The provision of a signal comprises the second step and we refer to the signal as a 'hint.' We tell them that each participant will observe an informative hint, meaning that the higher (lower) the hint is, the more likely it is that the coin landed on heads (tails). The third step consists of them independently indicating whether they would rather talk (show the hint to the other) or listen (see the other's hint). The fourth step captures nature's move on whose decision is implemented. We tell participants that with 1/3 chance their choice is implemented, with 1/3 the other's choice is implemented, with 1/6 chance they will be forced to listen, and with 1/6 chance they will be forced to talk.[11] The selected choice is subsequently implemented. Finally, the fifth step consists of each of them submitting a report, which is a number between 0 and 100 that indicates the likelihood that the coin flip was heads. Prior to moving on to a new period they receive feedback on payoffs for the period.[12]

[10] As shown in Appendix A, the expected benefit from listening conditional on the least informed person's belief determining the payoffs is positive equal to $3/4 + (1/12)\tau_{-i}^2$.

[11] Having choices imposed on them does not change theoretical predictions, but this feature will allow us to construct a counterfactual in which the choice is independent of the participant's decisions. We can then compare the outcome in such counterfactual to cases in which the implemented decision depends on participant's choices.

[12] This corresponds to the sixth step in our theoretical timing for the game. Specifically, they are reminded of their hint, whether they selected to talk or listen, and their final report. They are also provided with the same information for the person they are matched with (hint, decision to talk/listen and final report). They also learn whose decision was selected to determine payoffs, the state of the world and the payoff they would receive if the period was selected for payment.

A session is divided into two parts. Part 1 consists of the first 5 periods in which the implementation is as described above. Part 2 consists of the remaining 25 periods, where we use the strategy method to elicit a critical signal. Specifically, before learning the realization of the signal, participants indicate a critical signal, such that for realizations beyond that signal they will talk. Details on the implementation, including screen shots of the interface are available in Appendix B.

Treatments. We conduct three treatments in our abstract design. In the *AbsHard* treatment the signal is relatively uninformative, making inferences less reliable. We set $\tau_1 = \tau_2 = 0.6$. Meanwhile, the informativeness of the signal is higher in the *AbsEasy* treatment, where we set $\tau_1 = \tau_2 = 0.9$. As a reference, observing a signal of 70 in *AbsEasy* is equivalent to observing a signal of 80 in *AbsHard* in terms of the information it conveys on the state being heads relative to tails. For another comaprison, observing a signal of 80 in *AbsEasy* makes it approximately 57 percent more likely that the state is heads, relative to observing a signal of 80 in *AbsHard*.

In treatments *AbsHard* and *AbsEasy*, however, the informativeness of the signal is symmetric for both players. The theoretical prediction is that in both cases participant choose a critical signal value of $c^\star \approx 0.79$, independent of their risk preferences and independent of the treatment that they are in. Following Hypothesis 1, in contrast, we expect a higher cutoff in *AbsHard* than in *AbsEasy*.

As a reference treatment that we do not analyze in any detail, we also run an asymmetric treatment *AbsAsy*, where $\tau_1 = 0.9$ and $\tau_2 = 0.6$. Here, player 1's signal structure is more informative than player 2's. The prediction using Result 1 is that $c_1 = 0.69$ and $c_2 = 0.93$, that is, the interval for which player 1 would talk is substantially larger than that of player 2. In the asymmetric treatment we assign half of the participants to one of two "types" (and the other half to the other type), where each type corresponds to a possible level for the informativeness of the signal distributions. The type is fixed throughout the session and in each period subjects are told that they will be randomly matched with a subject of the other type.

3. Context Environment

Our context environment follows an analogous approach to the trade-off between talking and listening. Instead of using an abstract state- and signal-generating process, we use a more-real-world context with trivia questions. The design stays close to the abstract environment whenever possible, and the timeline of the game is the same described in Figure 1, with one exception: the signal-generating process (step 2) is endogenous to the participants and not controlled by the experimenter. As a consequence, while we introduce a degree of realism to our experiment, we no longer have a quantitative theory to base our predictions on. However, one can observe that the main features of the two games are in close parallel and it is therefore natural that the players' incentives have parallel features, too. We start by describing the implementation in detail and later outline our hypotheses for this environment.

3.1. **Experimental Design.** In each of 30 periods, subjects are randomly matched in pairs. In step 1 of each period they are presented with a trivia question and two possible answers. One of the answers is correct, but the correct answer is presented with fifty percent chance as option A, and with fifty percent chance as option B. So, before knowing the specific question, a reasonable (and true) prior about A being the correct answer is 50%. In step 2, participants write a short statement using their software interface, where they are encouraged to reveal their thoughts about the question, in unrestricted natural language. From here on, the period is identical to a period in the abstract design, except that the written statements take on the role of the quantitative signals. That is, in step 3, they decide whether to talk (share their statement with the other) or listen (see the other's statement), in step 4 nature implements a choice (with the same chances as in the abstract treatment), and in step 5 subjects report a belief.[13]

There are a couple of differences between the context relative to the abstract design. While the setting is clearly different (a verbal question, versus tossing a coin), the determination of the state of the world (prior to revealing the actual question in the context case) are identical. In the abstract case, the state of the world is the result of tossing a fair coin. One could match this to the context case by interpreting that heads (tails) translates into the correct answer being placed in option A (B). The main substantive difference is on the signal structure. In the abstract case, the signal structure is exogenous from the subject's perspective and controlled by the experimenter. In the context case, the signal corresponds to the subject's knowledge of the specific question, as written in her statement. That is, the signal in this case is endogenously generated by the subject.

3.2. **Generating trivia questions.** We aimed to generate the trivia questions for the context treatment in a way to stay as close as possible to our parameterization for the abstract environment. A summary of the procedure is in Appendix C with full details in section D.3 of the procedures appendix.

The procedure delivers 30 questions with binary answers (a correct and an incorrect answer), as well as a *hard* and *easy* version of the question. The easy version includes a hint of the answer in the question itself. For example, one question is: "Dendrophobia is the fear of what?" The two possible answers are: a) trees, b) spiders. The easier version of the question is: "Dendrophobia is the atypical fear of what?" That is, the easier version presumes that by adding the word 'atypical' participants will be more likely to select the correct answer (trees) because they may think that fear of spiders is relatively more common.

Initially, we generated 60 questions for which we checked in a calibration treatment to what extent the hard version was actually harder than the easy version. For hard version we intended to keep questions where the success rate lies in the $[0.45, 0.85]$ interval. Ex-ante there is a 50-50 chance that answer a is correct, so we considered questions where the success rate is below 50% to be relatively difficult and we set the lower bound at 45%. We also planned to discard questions where the 'hard' version was extremely easy, which is why we kept no questions above the 85% success rate threshold. We also imposed that

[13] Subjects subsequently receive feedback with information matching the information received in the abstract treatments.

for a given question, the success rate in the easy version would have to be higher than in the hard version. Finally, we also planned to restrict to questions where the success rate to the 'easy' version lies in the $[0.525, 0.925]$ interval. Out of the 60 questions we tested, only 25 satisfied these criteria. We added 5 more questions that were closest in terms of our ex-ante criteria for a total of 30 questions.

3.3. **Treatments and Hypotheses.** We thus have a hard and an easy version of each question in the environment with context. This translates into two context treatments in a between-subjects design, *ContHard*, and *ContEasy*.

Borrowing from our abstract environment, our hypothesis for optimal behavior is as follows. If participants anticipate that the answer to the trivia question is easy (hard), they would also anticipate that it is easy (hard) for others. Consequently, there would not be any treatment effect. Meanwhile, if participants do not take into account that what they themselves find easy (hard) would likewise be found (easy) hard by others, we expect more talking in *ContEasy* relative to *ContHard*.

4. Data and Results

4.1. **Data.** For both experimental designs, we recruited participants from the subject pool of the Experimental and Behavioral Economics Laboratory at UC Santa Barbara using ORSEE (Greiner, 2015) and the sessions were conducting using z-tree (Fischbacher, 2007). We used a between-subjects design and conducted four sessions for each of our five treatments with a total of 370 participants.[14]

Each session took approximately 90 minutes. There was a \$5 show up fee. In addition, they could receive \$20 from payment in one randomly selected period. That is, we set $X = 20$ in our binarized scoring rule. We implemented the scoring rule using the procedure described in Wilson and Vespa (2018). The average payment was \$21.5.

4.2. **Results I: Hard-easy effects.** We first consider the effects of treatment in the abstract treatments. In periods 6 through 30, the participants indeed showed a higher threshold for talking in treatment *AbsHard* than in *AbsEasy*; accordingly they talked less often in *AbsHard* than in *AbsEasy*. The respective means of the participants' thresholds are 75.9 (std. dev. 8.1) in *AbsHard* and 72.3 (std. dev. 7.0) in *AbsEasy*, and the respective medians are 75 in *AbsHard* and 71 in *AbsEasy*. (All of these reported thresholds are presented as the upper of the two boundaries of the range of signal values where a participant remains silent. The lower boundary is given by 100 minus the upper boundary.)

The differences also translate into a significant treatment difference in the frequencies of talking. In *AbsHard*, the realized frequency of talking is 0.48, compared to 0.53 in *AbsEasy*, which is significant at $p = 0.05$ in a t-test clustered at the participant level.

Figure 2 shows that the treatment difference does neither grow nor shrink over the course of the experiment. It depicts the evolution of each treatment's average of the participants' threshold values. The two average values both remain fairly constant and their distance remains constant at about four percentage points. Figure 3 shows the distribution of

[14]There were: 76, 68, 80, 72 and 74 participants in the *AbsHard*, *AbsEasy*, *AbsAsy*, *ContHard*, and *ContEasy* treatments, respectively.

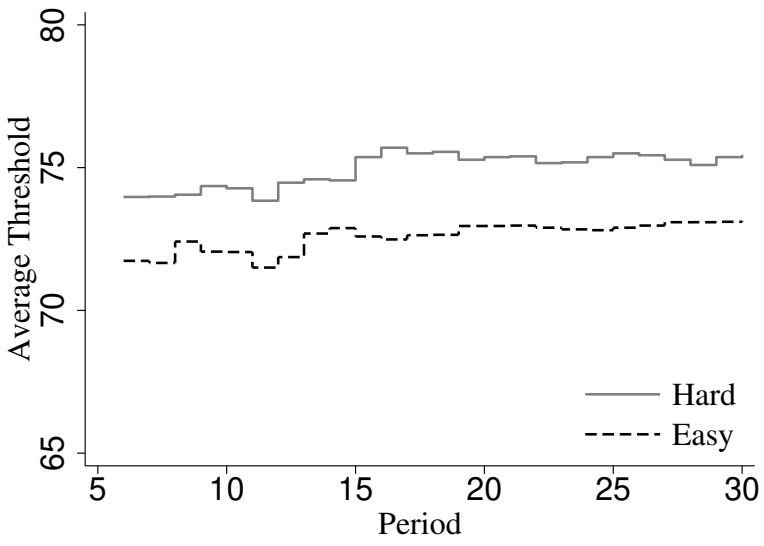

FIGURE 2. Average thresholds as the sessions evolve across abstract treatments.

critical values (aggregated over all 25 periods starting in period 6) and illustrates that between the two treatments, large parts of the distribution are shifted by a similar distance. In sum, there is a fairly robust treatment effect between *AbsHard* and *AbsEasy*, confirming Hypothesis 1 for the abstract treatments.

For the Context treatments, where the information structure is embedded in the quiz question, there does not exist a threshold and the analysis is therefore restricted to using the talk/listen decisions. Overall, the frequencies of talking are 0.38 in *ContHard* and 0.51 in *ContEasy*, a highly significant difference ($p = 0.01$, clustered t-test). That is, talking frequencies are consistent with translating Hypothesis 1 to this environment: easier questions lead to more talking, despite the fact that they are easier for everyone.

However, with natural context and language, the treatment variation may not impose the same degree of varying the difficulty, compared across the 30 quiz questions. Participants may perceive the additional words in *ContEasy* as helpful in some questions, and less so in others. We therefore now consider this heterogeneity compare the treatment effect separately for those questions where the treatment worked in a statistically significant way, versus those were it was less strong. Such sample splits are feasible in our study because we can observe suitable proxies of treatment strength that are not influenced by the participants' decision to talk.

More precisely, we consider the guesses $\{p_i\}_i$ for all those games where a participant i was randomly forced to talk.[15] On this subset, we identify 15 out of the 30 questions where the treatment had a statistically significant effect on $\{p_i\}_i$, at a level of no more than $p = 0.05$ in two-sided t-tests.[16] Among those 15 questions, the talking frequency is at 0.57 in *ContEasy*, significantly higher than the 0.37 in *ContHard*. The difference

[15]These are cases where they could not have collected any information from the opponent.

[16]The appendix described the split in more detail.

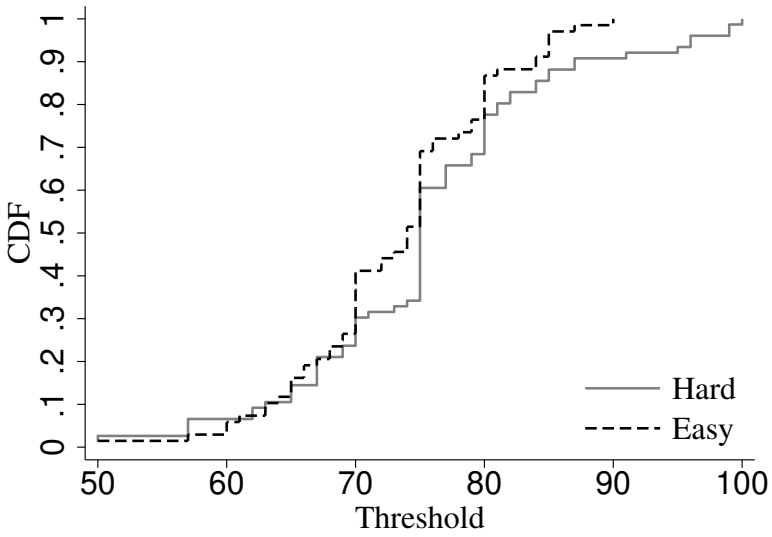

FIGURE 3. Distribution of thresholds across abstract treatments.

is statistically significant at $p = 0.01$ (clustered t-test) and it is also larger than in the remaining group of 15 questions where the effects were not significant on a question-by-question basis. In this latter group of questions, the treatment effect on the talking frequency is, nevertheless, still significantly postive: the frequencies are is at 0.46 in *ContEasy* and 0.38 in *ContHard*, with a significance level (clustered t-test) of $p = 0.043$. The difference in the treatment effects between the two groups of (each) 15 questions is significant at $p = 0.01$.[17]

Another relevant split concerns the participants: we separate them into more versus less knowledgeable in a median split, within the distribution of the treatment that the participants are in: either above-median knowledge, or below.[18] Table 1's first column shows the results of an OLS regression where the decision to talk is the dependent variable. The estimates show that for the more knowledgeable participants, the treatment has a positive and significant effect, increasing their average frequency of talking from 0.45 (the sum of coefficients for the constant and the dummy for being knowledgeable) to 0.55 (adding the two other coefficients). For the less knowledgeable set of participants, the treatment

[17] In an ongoing analysis, we conduct a second type of split according to treatment strength: a quantification of the verbal assessments. Research assistants (whom we did not inform about the research question at hand) transformed all verbal assessments into a quantitative estimate of the subjective probability of the first answer option, resulting in a numeric measure $q_{i,t}$ that quantifies participant i's posterior belief in quiz question t as expressed through the statement $q_{i,t}$, for all i and t. For details on the coding procedure, see Procedures Appendix D.5. Next, we check for each quiz question whether the mean of $q_{i,t}$ lies significantly further away from 0.5 in *ContEasy* than in *ContHard*, at a significance level of $p = 0.10$ (two-sided t-test). Currently, we have the results only for the comparison of *ContHard* and the preliminary easy treatment that we described at the end of the previous section. Here, seven out of thirty quiz questions have this property. For these seven questions, the frequency of talking in the preliminary easy treatment is at 0.37 in *ContEasy*, significantly higher than the 0.26 in *ContHard* ($p = 0.02$, clustered t-test).

[18] The measure of a participant's average knowledge is the distance from the truth, for all cases where the participant was forced to talk. The next subsection describes this distance measure in more detail.

has a significantly larger effect on talking frequency, by seven percentage points. The second column of the table also shows that all coefficients are of similar size if the sample is restricted to questions where the treatment had a significant impact on each separate questions, as measured by the method described above.[19]

	Context	Context_15
knowl.	0.15^{***}	0.14^{***}
	(0.02)	(0.03)
easy	0.17^{***}	0.21^{***}
	(0.02)	(0.03)
*knowl.*easy*	-0.07^{**}	-0.05^{*}
	(0.03)	(0.04)
constant	0.30^{***}	0.31^{***}
	(0.01)	(0.02)
N	4380	2190

TABLE 1. Context treatments: Decision to talk

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data in *Context_treat* are 7 questions where treatment effect on $\{p_i\}$is positive at $p = 0.10$. Coefficients of *knowl.* and *knowl.*easy* are different at $p = 0.44$ and $p = 0.04$, respectively in *Context* and *Context_treat* (clustered t-test, 2-sided).

Overall, we find that whenever the treatment works, the frequency of talking is larger for easier questions. This effect is driven by the less knowledgeable subjects in the quiz questions.

4.3. **Results II: Talking too much?** The previous subsection demonstrated that participants talk relatively more when the information that is available to them is more precise. The present section investigates the extent to which this has economic consequences in the present experiment. It reiterates the paper's title by asking whether talking is too frequent when held to the empirically optimal threshold. Overall, we find that the participants are remarkably successful in identifying the empirically optimal talking strategy.

As a variable that measure success in the experiment, we record for each game the ex-post precision of the player $\tilde{l}$ who had only one signal available when making her guess. This can come about because the player chose to listen or her opponent chose to talk, or because the computer randomly determined that $\tilde{l}$ listens. (The other player, $-\tilde{l}$, has two signals available and adding their precision would only add noise to the success measure.) We record the ex-post prediction error by player $\tilde{l}$:

$$p_{\tilde{l}}^{diff} = \begin{cases} p_{\tilde{l}} & \text{if } \omega = 0 \\ 1 - p_{\tilde{l}} & \text{if } \omega = 1 \end{cases}$$

The decision to talk/listen changes the identity of player $\tilde{l}$, and the measure $p_{\tilde{l}}^{diff}$ therefore allows to classify whether it is better to talk or to listen: we can identify an ex-post optimal talk/listen decision and check whether participants choose it. Importantly, this

[19] A noteworthy difference occurs if we compare *ContHard* with another treatment, described in the appendix, that has a milder reduction of task difficulty. In this comparison, the hard/easy is *larger* for participants who are more knowledgeable.

All Observations

	AbsHard a_i = Talk optimal	*AbsHard* a_i = Listen optimal	*AbsEasy* a_i = Talk optimal	*AbsEasy* a_i = Listen optimal
$\Pr(a_i = \text{Talk})$	0.86	0.19	0.88	0.18
N	996	1280	1033	1007

Marginal Observations

	AbsHard a_i = Talk optimal	*AbsHard* a_i = Listen optimal	*AbsEasy* a_i = Talk optimal	*AbsEasy* a_i = Listen optimal
$\Pr(a_i = \text{Talk})$	0.78	0.52	0.69	0.48
N	290	201	224	203

TABLE 2. Frequencies of Talking and Listening

Note: Data from symmetric abstract treatments. a_i = Talk optimal and a_i = Listen optimal: according to predicted values $p_{\tilde{l}}^{diff}$ from polynomial regression.

classification does not rely on theoretical considerations but, instead, uses the empirical value of talking or listening.

The first analysis of talking success asks whether participant talk when they should. That is, we use the precision measure $p_{\tilde{l}}^{diff}$ to determine cases where it is empirically optimal to talk and we then ask whether participants in fact talk in these cases.

To determine cases where it is optimal to talk, we exploit the random imposition of talking and listening. This computer draw of forced talking/listening is orthogonal to all decisions in the experiment and we can therefore compare, for any given decision to talk/listen, which of the two choice options is empirically more successful. In the abstract treatments, we can make this comparison for each signal value and estimate the empirically optimal threshold value, at which the participants would ideally switch from listening to talking. The result for *AbsHard* is that it is empirically optimal to talk if s_i lies above 0.785 or below 0.215, and for *AbsEasy* it is empirically optimal to talk if s_i lies above 0.745 or below 0.215.[20]

Table 2 shows the frequencies of talking and listening separate for all cases where the estimated empirical values, as described in the previous paragraph, indicate that it is optimal to talk versus cases where it is optimal to listen, separately for the two symmetric abstract treatments. The top table shows the frequencies for all observations in these treatments, and the bottom table restricts attention to the marginal cases, where the signal is within five percentage points of the empirically optimal cutoff.

[20]The underlying estimation is an OLS regression of the empirical precision ($p_{\tilde{l}}^{diff}$) where the signal enters in linear, squared and cubed values as explanatory variables.

	AbsHard		*AbsEasy*		*AbsHard* & *AbsEasy*	
	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$
	a_i = Talk	a_i = Listen	a_i = Talk	a_i = Listen	a_i = Talk	a_i = Listen
forced to listen	0.07**	–	0.13***	–	0.10***	–
	(0.03)		(0.03)		(0.02)	
forced to talk	–	0.06**	–	0.13***	–	0.10***
		(0.03)		(0.03)		(0.02)
constant	0.37***	0.38***	0.25***	0.37***	0.31***	0.37***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
N	361	379	335	311	696	690

TABLE 3. Precision in cases where subjects are forced to to do the opposite of what they want – Abstract treatments

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ in subject-clustered t-test, 2-sided.

The tables show that in cases where it is empirically optimal to talk, the large majority of participants do so, and this is true also for the marginal cases. In cases where it is empirically optimal to listen, the large majority of participants listens. But in cases that favor listening by a small margin (bottom of Table 2), the optimal choice is made only with probability of about 0.5. This indicates that participants have an the overall tendency to talk, relative to the empirically optimal frequencies.

	ContHard		*ContEasy*		*ContHard* & *ContEasy*	
	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$	$p_{\tilde{l}}^{diff}$
	a_i = Talk	a_i = Listen	a_i = Talk	a_i = Listen	a_i = Talk	a_i = Listen
forced to listen	0.16**	–	0.09***	–	0.12***	–
	(0.04)		(0.02)		(0.02)	
forced to talk	–	0.10**	–	0.10***	–	0.10***
		(0.03)		(0.03)		(0.03)
constant	0.10***	0.32***	0.04***	0.13***	0.06***	0.24***
	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
N	233	381	383	325	616	706

TABLE 4. Precision in cases where subjects are forced to to do the opposite of what they want – Context treatments

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ in subject-clustered t-test, 2-sided.

A separate analysis shows, however, that the overall tendency to talk is not of large economic relevance. Table 3 shows the results of an OLS regression of the imprecision $p_{\tilde{l}}^{diff}$ on an indicator of being forced to listen, for those cases where a participant decided to talk, and on an indicator of being forced to talk, for those cases where a participant decided to listen. The first portion of the table corresponds to *AbsHard* and the middle portion to *AbsEasy*. If the decision to talk appeared too often in a meaningful extent, then

being forced to listen would reduced the imprecision, i.e. show a negative coefficient. The table shows, however, that being forced to do the opposite of what one wants to do increases the imprecision, i.e. the indicator has a positive coefficient.[21] This suggests that, in the aggregate, participants do not give up significant amounts of monetary rewards by talking too much.

Table 4 replicates these analyses for the context treatments. Here, too, being forced to do the opposite of what a player wants to do increases the prediction error.

5. Conclusion

The implicit guarantee of relevance (Sperber and Wilson, 1995) is of crucial help in the interpretation of a statement: it says that a potential talker would talk only if she has something sufficiently relevant to say. In an economist's language, the listener knows that the talker is maximizing her utility by making the statement, which rules out many possible interpretations of the of the statement. However, the listener's updating is also made more difficult by the implicit guarantee of relevance: the listener must condition on the *fact* that the talker decided to talk. This fact implies relevance, too: the talker is sufficiently confident that what she says is relevant, and the listener would not know about this confidence of the talker if the statement was, say, written down by someone else instead of having been said by the talker. However, the reason why the talker is so confident is usually not included in the statement itself, leaving room for interpretation on behalf of the listener. A quantitative assessment, like a probability update, is therefore quite difficult in most natural-language conversations.

In the game we introduce in this paper, we intentionally avoid this complication of updating based on the fact of a statement's utterance. Our game is designed so that the a talker wants to talk only if she is well-enough informed, but the fact of talking is not informative over and above the statement because the message contains all information that the talker has. (See footnote 3.) It may be that this is overly strong simplification and that in real-life conversations, the informativeness of the fact of talking is very important. It certainly deserves further study. (Note that, in particular, an anlogous argument can be made about the topic of a conversation: The fact that one talks about a topic is informative about the topic's relevance.)

Nevertheless, this paper is a start and we regard it as important to investigate the decision to talk or listen also in cases where the inference in not complicated by the above considerations. We believe that our game captures the gist of the implicit guarantee of relevance: its rules do make sure that a talker does indeed talk if and only if her information is relevant enough. That is, the talker asks herself whether it is more precise than what the other person would say. Whether or not an interlocutor's information satisfies this threshold is, arguably, the first-order consideration in the decision of whether or not to talk.

[21] Qualitatively, this results is robust to considering only marginal cases.

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Appendix A. Proofs

Proof for Result 1. We want to find a cutoff c_i that is optimal for agent i. Let $\tilde{r}_i$ ($\tilde{r}_{-i}$) be agent i's ($-i$'s) posterior after having observed s_i (s_{-i}). We start by showing when the expected value of talking for i is higher than that of listening for a *fixed* state of the world and *fixed* signal for $-i$.

Remark 1. *Assume $\omega = 1$. Agent i wants to talk if: $1-(1-\tilde{r}_i)^2 > 1-(1-\tilde{r}_{-i})^2$. Alternatively, assume that $\omega = 0$. Agent i wants to talk if: $1-\tilde{r}_i^2 > 1-\tilde{r}_{-i}^2$.*

Proof. Assume $\omega = 1$ and that i's choice is implemented. Let us first compute i's expected payoff of talking. With 1/2 chance agent i's reported belief is selected to determine payoffs. Since agent i talks and is incentivized to report truthfully, she will report her posterior after having observed s_i, $\tilde{r}_i$. Meanwhile, with 1/2 probability agent $-i$'s report is the one selected and since agent i talked, agent $-i$ will have observed two signals. Her report, $\tilde{\tilde{r}}_{-i}$, is agent $-i$'s posterior, after observing s_{-i} and s_i. Therefore, i's expected value of of talking is $1/2(1-(1-\tilde{r}_i)^2) + 1/2(1-(1-\tilde{\tilde{r}}_{-i})^2)$.

In a similar fashion, we can compute i's expected payoff of listening. In this case, she will have observed both signals and her final report would be $\tilde{\tilde{r}}_i$. Agent $-i$ will only have observed her own signal, but prior to submitting a belief she will know that the other's decision is implemented and that the other decided to listen. Let $\mathring{\tilde{r}}_{-i}$ be $-i$'s posterior belief after having observed s_{-i}, and that i's choice to listen is the one implemented. The expected payoff of listening for i is thus: $1/2(1-(1-\tilde{\tilde{r}}_i)^2) + 1/2(1-(1-\mathring{\tilde{r}}_{-i})^2)$.

Noticing that $\tilde{\tilde{r}}_i = \tilde{\tilde{r}}_{-i}$, agent i prefers to talk if: $(1-(1-\tilde{r}_i)^2) > (1-(1-\mathring{\tilde{r}}_{-i})^2$.

Finally, we note that $\mathring{\tilde{r}}_{-i} = \tilde{r}_{-i}$. After having observed s_{-i}, agent $-i$'s posterior is $\tilde{r}_{-i}$, which takes on the role of prior when computing $\mathring{\tilde{r}}_{-i}$, the posterior that results after being additionally told that i's choice to listen is implemented. Using Bayes' rule and the distributions from which the signals are drawn we get:

$$\mathring{\tilde{r}}_{-i} = \frac{\tilde{r}_{-i}\Pr(s_i \in [(1-c_i), c_i] \,|\, \omega = 1)}{\tilde{r}_{-i}\Pr(s_i \in [(1-c_i), c_i] \,|\, \omega = 1) + (1-\tilde{r}_{-i})\Pr(s_i \in [(1-c_i), c_i] \,|\, \omega = 0)}$$

$$\mathring{\tilde{r}}_{-i} = \frac{\tilde{r}_{-i}(2c_i - 1)}{\tilde{r}_{-i}(2c_i - 1) + (1-\tilde{r}_{-i})(2c_i - 1)} = \tilde{r}_{-i}$$

Intuitively, the reason why extra knowledge that "i's choice to listen is implemented" does not change $-i$'s beliefs is that this knowledge does not provide any information on which of the two states is more likely.

Hence, agent i prefers to talk if: $(1-(1-\tilde{r}_i)^2) > (1-(1-\tilde{r}_{-i})^2$. This calculation shows that the expected payoff of talking is higher than that of listening if the expected payoff of talking and having the least informed person report is higher than the payoff of listening and having the least informed person report. This completes the proof of the remark for the case $\omega = 1$. Following essentially the same steps we can obtain the result for the $\omega = 0$ case. □

Remark 1 solves the problem fixing the other's signal, so that $\tilde{r}_{-i}$ is fixed. The following remark updates Remark 1 correcting for the fact that agent i can only compute the expectation for the other's posterior at the time she makes a decision.

Remark 2. *Assume $\omega = 1$. Agent i wants to talk if:* $1-(1-\tilde{r}_i)^2 > 3/4 + (1/12)\tau_{-i}^2$. *Alternatively, assume that $\omega = 0$. Agent i wants to talk if:* $1-\tilde{r}_i^2 > 3/4 + (1/12)\tau_{-i}^2$.

Proof. Consider the $\omega = 1$ case first. For a given s_{-i}, agent i wants to talk if $1-(1-\tilde{r}_i)^2 > 1-(1-\tilde{r}_{-i})^2$ by Remark 1. Though agent i does not know s_{-i} at the time when she decides to talk or listen, she can compute the expectation of the right-hand side of the inequality:

$$1-(1-\tilde{r}_i)^2 > E\Big(1-(1-\tilde{r}_{-i})^2\Big|\,\omega = 1\Big).$$

Using Bayes's rule and the density for $-i$'s signal when $\omega = 1$, we can compute $-i$'s posterior. We obtain $\tilde{r}_{-i} = 1/2(1+\tau_{-i}(2s_{-i}-1))$. Replacing and simplifying the inequality, we get the result.

$$\begin{aligned}
1-(1-\tilde{r}_i)^2 &> E\Big(1-(1/2(1-\tau_{-i}(2s_{-i}-1)))^2\Big|\,\omega = 1\Big)\\
1-(1-\tilde{r}_i)^2 &> \int_0^1 \Big(3/4 - \tau_{-i}/2(1+\tau_{-i}/2) + \tau_2(1+\tau_{-i})s_{-i} - \tau_{-i}^2 s_{-i}^2\Big)(1+\tau_{-i}(2s_{-i}-1))\,ds_{-i}\\
1-(1-\tilde{r}_i)^2 &> 3/4 + (1/12)\tau_{-i}^2
\end{aligned}$$

Proceeding in a similar manner, we obtain the result for the $\omega = 0$ case.

□

We can now proceed to show that $c_i^\star = \frac{1}{2} + \frac{\sqrt{3}}{6}\frac{\tau_{-i}}{\tau_i}$. Per Remark 2, notice that regardless of the state of the world, the expected benefit of listening if the least informed person's report is used is $3/4 + (1/12)\tau_{-i}^2$.

Meanwhile, the the expected benefit of talking if the least informed person's report is used depends on the state of the world. Moreover, after having observed s_i, the likelihood that the state is $\omega = 1$ ($\omega = 0$) from the perspective of i is $\tilde{r}_i$ (1-$\tilde{r}_i$). So, the expected benefit of talking if the less informed person reports is given by: $\Big(1-(1-\tilde{r}_i)^2\Big)(\tilde{r}_i) + \Big(1-\tilde{r}_i^2\Big)(1-\tilde{r}_i)$. Using $\tilde{r}_i = 1/2(1+\tau_i(2s_i-1))$, the benefit of talking if the less informed person reports can be simplified to: $3/4 + (1/4)\tau_i^2 - \tau_i^2 s_i + \tau_i^2 s_i^2$.

The cutoff $c_i^\star$ is the signal s_i such that the benefit of talking equals the benefit of listening conditional on the least informed person reporting. There are two values of $c_i^\star$ that solve the quadratic equation $(1/4)\tau_i^2 - \tau_i^2 c_i^\star + \tau_i^2 c_i^{\star 2} = (1/12)\tau_{-i}^2$. Specifically, $c_i^\star = \frac{1}{2} \pm \frac{\sqrt{3}}{6}\frac{\tau_{-i}}{\tau_i}$. The values are symmetric around 1/2, and we take the root with a positive second term since we define the cutoff to be higher than 1/2.

Depending on the value of $\frac{\tau_{-i}}{\tau_i}$ it is possible that the solution is higher than one. This happens when the precision of $-i$'s density is much higher than that of i's. In this case,

$c_i^\star = 1$ in the sense that agent i would want to listen for any signal they may receive. If the opposite happens (i.e. i's precision is much higher than $-i$'s), then the cutoff converges to $1/2$ and i would choose to talk for any signal they receive.

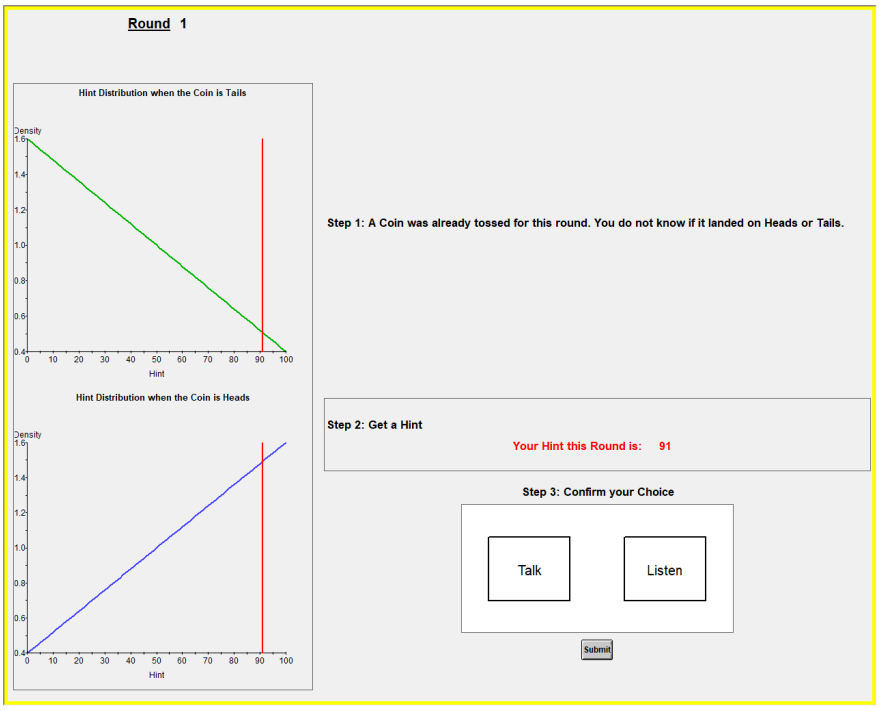
Notice that since there are no other intervals that solve the equation besides $[1 - c_i^\star, c_i^\star]$, the cutoff equilibrium is unique.

Appendix B. Implementation of the Abstract Setting

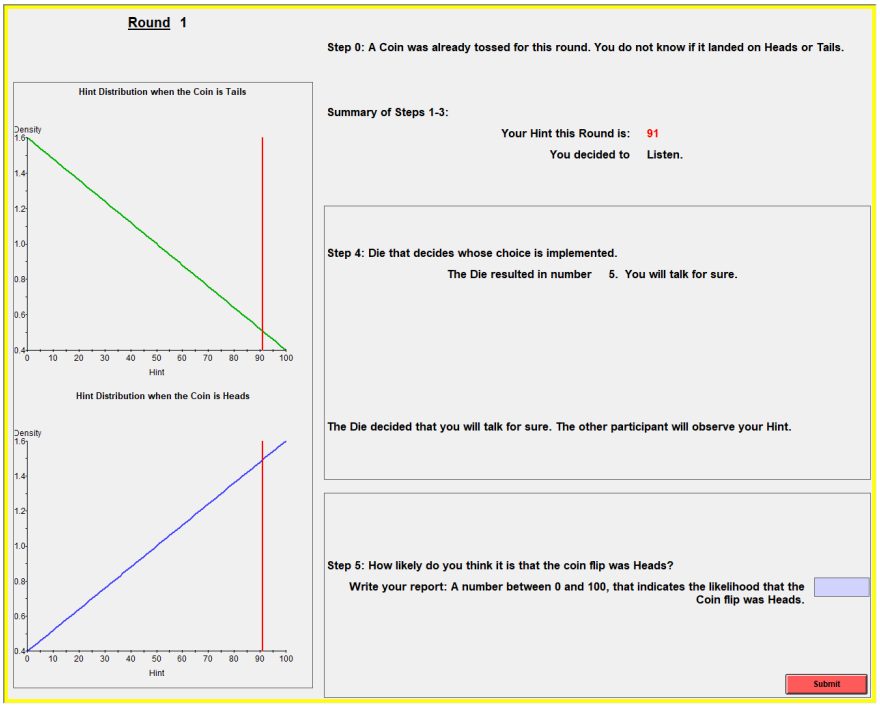
To make sure subjects are familiarized with the environment, we proceed in a number of steps. The full protocol is presented with details in Appendix D. We distribute written instructions that introduce subjects to the main structure of the round that we just described. In this description we do not provide details on how the hint is generated. But once we finish with an overview of the round, we explain in more detail how a hint is generated. The portion of the instructions that introduces the hint is interactive in the sense that the experimenter reads a script while subjects follow the information on their screens. The information corresponds to how the hint process is presented to them in a typical round. Specifically, we visually present and describe the distributions from which signals are drawn, and subsequently subjects have to answer a number of understanding questions.[22] They are not allowed to move forward until they answer all questions correctly.

Once they finish with the explanations on the hint generating process, we introduce them to a round using the interface. Again, they follow interactively the protocol that the experimenter is reading. Details are reported in Appendix D, but as a reference a screen shot is presented in Figure A.1, which corresponds to the *AbsEasy* treatment. Panel A presents what the interface shows at the beginning of step 3. In each round, steps are introduced one by one to remind subjects of the timing. Subjects are first told that a coin has already been tossed and that in step 2 they direct the interface to get a hint for them. Subsequently, they are shown the hint as a number (91 in the example) and also in the distributions on the left side of their screens, as they were trained to interpret during the hint instruction period. After observing the hint, step 3 appears and they can indicate whether they would like to talk/listen. Afterwards the software moves on to Step 4, which is presented in Panel B. The left-side of their screens remains unchanged and the top portion of the right side summarizes steps 1-3. When step 4 appears they are instructed to press a button that reveals the choice that will be implemented. The procedure is described to subjects as rolling a fair six-sided die. In the example presented

[22] An example of a question that subjects would have to answer is as follows. For instance, assume that the hint is 91. Subjects would only see on their screens the left-hand side distributions presented in Panel A of Figure A.1, where we display the hint as a vertical red line. During the instruction period, the following question would appear on their screens: "Suppose the Hint you see is equal to 91 as shown on the figures. Which of the following statements is correct? a) The coin is more likely to have landed on heads; b) The coin is more likely to have landed on tails, c) The coin is equally likely to have landed on heads or tails." Subjects have to answer questions where each of the three cases is correct. In addition, we also ask them questions in a different form: "Suppose that the coin landed on tails. Which of the following statements is correct? a) I am more likely to observe a hint equal to 5, b) I am more likely to observe a hint equal to 95."



(A) Steps 1-3



(B) Steps 4-5

FIGURE A.1. Screen shot: Example of a Round in Part 1

in Panel B the result is that the subject is forced to talk.[23] Since in the example the subject talks, there are no changes and the screen shot is actually taken at the time the subject is asked to submit a belief in step 5. If, instead, the subject had listened, the step 4 box would have also displayed the numerical hint of the other, which would also have been represented with vertical lines on the right-hand side figures. Once they submit the step 5 belief, they are provided with feedback for the round.

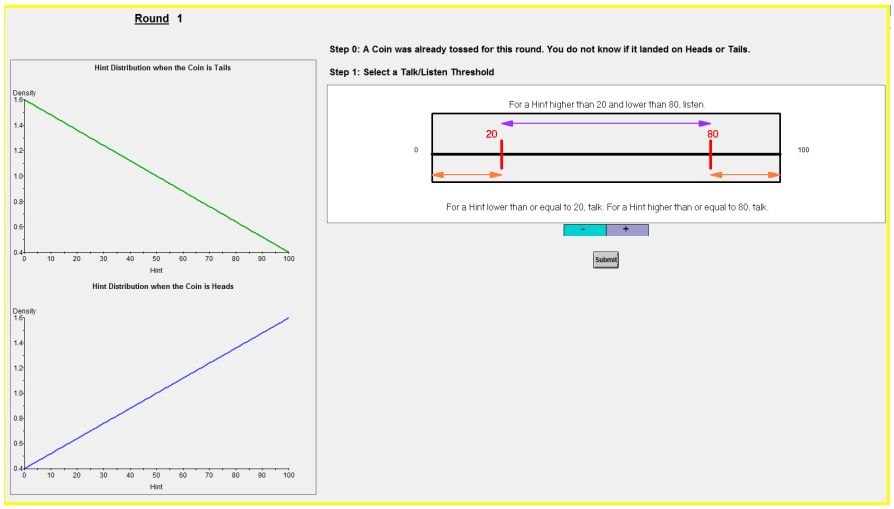
Strategy method for the talk/listen choice. After subjects have experienced 5 periods, we introduce the strategy method for the talk/listen choice. Details on the introduction of the strategy method are also reported in Appendix D, but we provide a summary review here. We ask subjects to follow on their screens the instructions that that the experimenter reads. Figure A.2 provides screen shots of the changes, that only apply to steps prior to step 4. Step 0 corresponds to what was step 1 in part 1, simply informing subjects that a coin has already been tossed. Next, subjects have to indicate an interval of hints for which they would like to talk, with the understanding that they would listen otherwise. That is, they indicate this interval prior to knowing the specific hint that is drawn for the period. Focusing on Panel A of Figure A.2, they can click anywhere in the interval to select a threshold.[24] The software is programmed to select a symmetric cutoff on the side of the interval that subjects did not click on. For example, if they click on value 20, the upper bound of the interval is placed at 80. The understanding of such a choice is that the subject would like to talk for hints from 0 to 20 or from 80 to 100, and would like to listen if she receives any hint in $(20, 80)$.[25] Once they click on submit they can no longer change their choice of listen/talk intervals.

Panel B of Figure A.2 displays what happens after subjects submit their choice. Specifically, from here on the interface repeats what subjects experienced in part 1. In Step 2, they ask the interface to provide a hint and subsequently in step 3 they have to select talk/listen. We impose that their talk/listen choice must be consistent with their interval choice. For example, consider that a subject after observing a hint of 22, as displayed in Panel B, clicks on 'Talk.' This is inconsistent with the interval choice made in step 1 because there the subject indicated she would want to listen for hints strictly in $(20, 80)$. In this case, the interface would produce a pop-up message that informs the subject of the inconsistency. It asks them to modify their talk/listen choice so that it is consistent

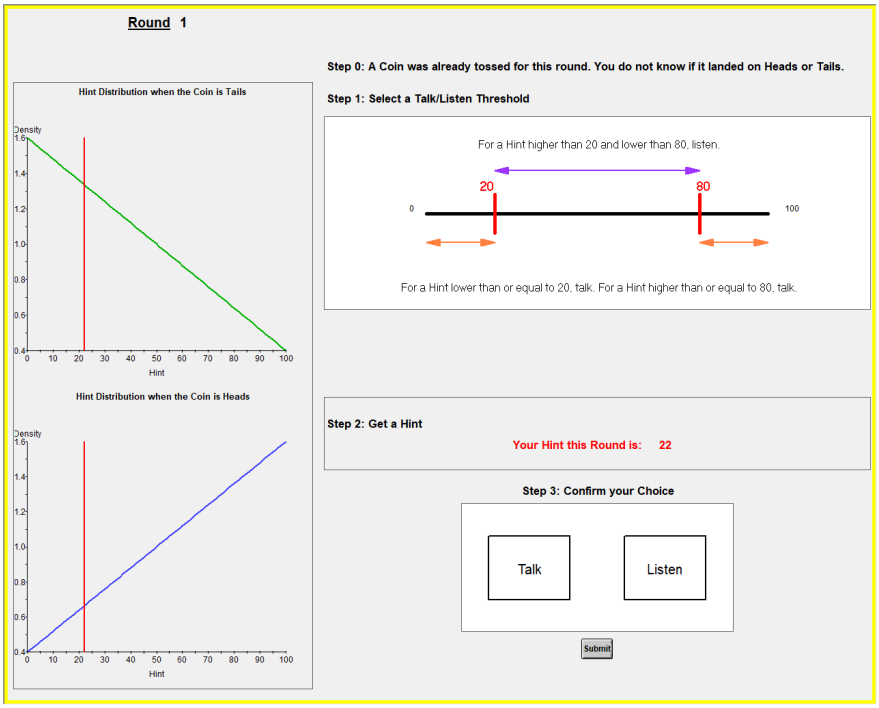
[23] Subjects know that in the instruction period, as we explain how to use the interface, their choices do not count for payment. However, we reproduce a period close to what they would go through when they are playing for money. For example, a hint is randomly generated for each subject in step 2 and they are free to select talk/listen in step 3. In step 4, however, we impose during the instruction period that the interface selects for everybody that they would have to talk for sure. We do this so that they would not observe any information from other participants during the instruction period.

[24] We will refer to the subjects' choices as a threshold, which will be contrasted against the equilibrium cutoffs derived in the previous section.

[25] If subjects select 50 exactly, then they would talk for all signals. If they select $x \in [0, 50)$, then the other end of the interval would be placed at $100 - x$. Likewise a choice of $x \in (50, 100]$ places the other end of the interval at x. Selecting x slightly to the left oft 0 or the right of 100 means that the subject listens for all signals. Subjects can modify their choice of thresholds by clicking anywhere else on the slider or by clicking on the +/- buttons at the bottom. Each click on + (-) expands (contracts) the listening interval by one unit on each end.



(A) Selecting an interval



(B) Confirming talk/listen choice

FIGURE A.2. Screen shot: Strategy method in Part 2

with their prior interval choice and reminds them that if they wish to, they can modify their interval choice next period. The aim of keeping the step 3 choice is twofold. First, we want to change the environment from part 1 to part 2 as little as possible. Second, we hope that by forcing them to indicate a talk/listen choice that must be consistent with the interval choice, we are helping subjects become familiarized with setting an interval. From step 4 onward, the interface in part 2 is identical to the screen shots for part 1.

The implementation of the asymmetric treatment largely follows what we presented for symmetric treatments, but in section D.2 of the procedures appendix we provide all details for the asymmetric treatment.

Appendix C. Generating trivia questions

We aimed to generate the trivia questions for the context treatment in a way to stay as close as possible to our parameterization for the abstract environment. The full procedure we used to genereate 30 questions is described in detail in section D.3 of the procedures appendix, but we summarize the process here. We provided research assistants with a protocol that asked them to go to a trivia-questions website and keep track of questions that are randomly generated by the website. They then have to produce a binarized answer (a correct and an incorrect answer), as well as an "easier" version of the question. The "easier" version involves the same original question, except that it also includes a hint of the answer in the question itself.

Our research assistants generated 60 trivia questions and then we conducted "calibration" sessions where some participants faced the original version of the 60 questions and others faced the "easy" versions.[26] The 60 questions are presented in section D.3 of the procedures appendix, and in each case we also report the fraction of participants who answered correctly each version of the question.

Of the 60 questions, we selected 30 to use in our main treatments, which were selected as described in the main text.

Notice that one difference between our implementation and the theoretical environment is that with $1/6$ chance we impose that subjects talk and with $1/6$ chance we impose that subjects listen regardless of their talk/listen choice. This is particularly useful as we can eventually condition on periods when subjects were forced to talk, for example, and learn what subjects would do if they do not receive an extra hint and they have to make a decision based on their own signal regardless of what they intended to do. Notice that in the context treatments, these periods are identical to what subjects in the calibration sessions faced. That is, we are able to verify if the conditions that we used to select the 30 questions are actually satisfied in the data. We found, actually, that in the main sessions the conditions to select the 30 questions we used were satisfied in fewer questions relative to the calibration sessions, particularly in our implementation of the 'easier' version. In other words, our implementation of the 'easier' version of the 30 selected questions did not actually involve easier versions. To generate a better baseline, we decided to ask two research assistants who were not previously involved with this project to generate an 'easier' version for each question. We provided both research assistants with the hard and easy versions for each question and asked them to use what they thought would be a stronger hint. We then reviewed the easier versions proposed by the research assistants and selected one of the two with the aim to keep the proposal with the strongest hint. This second implementation of 'easier' versions was successful and provided the baseline we were seeking. However, because our initial implementation of the easier version did

[26] Participants in these sessions did not participate in other treatments. They received a payment in addition to their show up fee if their answer to one randomly selected question was correct.

not actually implement easier versions we exclude it from the text and present it in the appendix.

Appendix D. Procedures

D.1. **Protocol for Conducting a Symmetric Abstract-Design Session.** We now present the protocol for conducting a symmetric abstract-design session, which consists of 8 stages.

Stage 0: An even number of subjects enters the laboratory. Subjects sign consent forms. Collect consent forms.

Stage 1: Start server and ztree in all computers. Set up ztree in the background. Start Powerpoint in the server. Open file Instructions.ppt. (*One slide, reproduced as Figure A.3*) Read the slide.

Stage 2: Distribute instructions in paper. Read instructions.

Instructions In this session you will make choices in a series of rounds. In each round you will be randomly matched with another participant, whom we refer to as "the other participant."

Each Round:

(1) In each round the computer is programmed to toss a fair coin. That is, with 50 percent chance the coin lands on Heads and with 50 percent chance the coin lands on Tails.

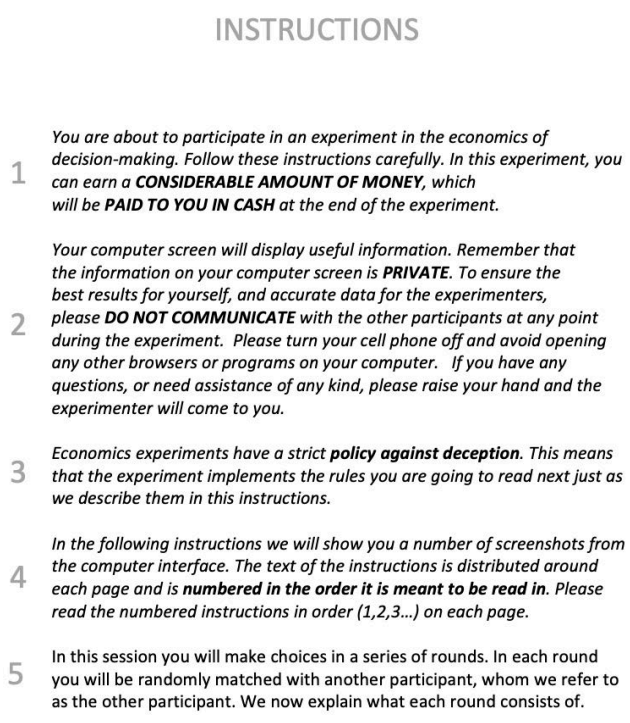


Figure A.3

(2) Without knowing whether the coin toss is Heads or Tails your task and the task of the other participant is to assess the likelihood that the coin toss was Heads or Tails.

(3) Only one of the two assessments will count, and it will earn some money for both of you, depending on accuracy. That is, if your assessment is selected, then the payoff to you and the other participant will depend on your assessment. If the assessment from the other participant is selected, then his/her payoff and your payoff will depend on his/her assessment. Both of you will make more money if either:

- the assessment predicts that the coin landed on Heads and it is indeed the case that it landed on Heads, or
- the assessment predicts that the coin landed on Tails and it is indeed the case that it landed on Tails.

(4) When you and the other participant make your assessments you do not know whether the coin toss resulted in Heads or Tails. However, you and the other participant will each receive a hint. A hint is a number that goes from 0 to 100. We refer to the hint you observe as "your hint" and to the hint that the other participant observes as "the other participant's hint." Later we will explain in detail how the interface generates the hints, but for now all you need to know is the following:

- The higher the hint is, the more likely it is that the coin landed on Heads;
- The lower the hint is, the more likely it is that the coin landed on Tails;

(5) **Your first task**: After you receive your hint, you will decide if you want to talk or listen. Talk means that you would like the other participant to observe your hint. Listen means that you would like to observe the other participant's hint. Likewise, after receiving a hint, the other participant will also decide if they want to talk or listen. If the other participant chooses Talk, it means that the other participant would like you to observe his/her hint. If the other participant chooses to Listen, it means that the other participant would like to observe your hint.

(6) The computer will throw a die with six equally probable outcomes, 1 to 6:

- If the die shows a 1 or a 2, then **your choice** is implemented:
  - You decided to talk: The other participant observes your hint.
  - You decided to listen: You observe the other participant's hint.
- If the die shows a 3 or a 4, then **the other participant's choice** is implemented:
  - The other participant decided to talk: You observe the other participant's hint.
  - The other participant decided to listen: The other participant observes your hint.

- If the die shows a 5, **you will talk for sure**: The other participant observes your hint.

- If the die shows a 6, **you will listen for sure**: You observe the other participant's hint. In each case, exactly one of you two will observe the other's hint.

(7) **Your second task**: After talking or listening, you will enter your assessment into the computer interface, which we call your "report." Your report is a number between 0 and 100 and indicates how likely you think it is that the coin flip was Heads. If your report is 100, it means that you are sure that the coin flip was Heads (0 chance that it was Tails). If your report is 0, it means that you are sure that the coin flip was not Heads (100 percent that it was Tails). If your report is 50, it means that you believe the chance of the coin flip being Heads is 50 percent (and, naturally, that the chance that the coin flip is Tails is also 50 percent). If your report is a number between 50 and 100—like 65, 70, 84, etc.—it indicates that you think Heads is more likely than Tails, with the percentage indicated by the number. And likewise, for a report between 0 and 50—like 16, 30, 35, etc.—which would indicate that you think Heads is less likely than Tails. While you submit your report, the other participant also submits a report about Heads or Tails, which we call "the other participant's report."

(8) **How your payoff is determined**. With equal chance, your or the other participant's report is selected to determine both of your payoffs. That is, the computer randomly selects one of the two reports. Let us call this report "SR" (for the "Selected Report"). Your payment and the other participant's payment will depend on SR and on whether the coin flip was Heads or Tails, as follows. The computer will randomly draw two numbers between 0 and 100. For each draw all whole numbers between 0 and 100 are equally likely to be selected. Draws are independent in the sense that the outcome of the first draw in no way affects the outcome of the second draw. Your payoff uses these two random numbers as follows.

   - If the coin toss was Heads and SR is larger than or equal to the smallest of the two random numbers, you and he/she each receive $20.

   - If the coin toss was Tails and SR is lower than the largest of the two random numbers, you and he/she each receive $20.

   - Otherwise, you and he/she each receive nothing.

   Note that as we explained above, the payment rule makes it lucrative for you to report a larger number if you think that it is more likely that the coin landed on Heads. Conversely, it makes it lucrative for you to report a smaller number if you think that Tails is more likely. But you cannot know for sure and therefore the report should neither be too high nor too low: the payment rule is purposefully designed so that you have the greatest chance of winning $20 when your report is indeed your true assessment on how likely it is that the coin toss was Heads.

Other details about this session:

- The session consists of 30 rounds. When a new round starts, you will be randomly matched with another participant in the session. It is not possible for you to tell if you have interacted with the same participant in a previous round and it is not possible for them to tell if they have interacted with you in a previous round.
- To determine your payment at the end of the session one of the 30 rounds is randomly selected. For each participant, a separate selection is made and all rounds have an equal chance of being selected. In addition to the $5 show up fee you will receive the payment you made in the randomly selected round.
- The experiment is divided into two parts. Part 1 consists of 5 rounds. Part 2 consists of 25 rounds. Part 2 is identical to part 1 except that the interface will allow for an alternative way to submit your choices.

Summary of each round:

- Step 1: A coin is flipped. You and the participant you are matched with will not be told if the coin landed on Heads or Tails.
- Step 2: You are shown a hint, which is a number between 0 and 100. The higher the hint is, the more likely it is that the coin landed on Heads. The lower the hint is, the more likely it is that the coin landed on Tails. The other participant is also shown a hint.
- Step 3: You decide whether talk or listen. The other participant decides whether to talk or listen. Talk means that one person would like to share the hint with the other person. Listen means that one person would like to see the other person's signal.
- Step 4: The computer decides which choice is implemented by rolling a die. It is possible that your choice is implemented, that the other participant's choice is implemented, that the computer decides that you talk and the other participant listens, or that you listen and the other participant talks.
- Step 5: You and the other each submit a report, which is a number between 0 and 100. The number indicates how likely you think it is that the coin flip was Heads.
- Step 6: One of the two reports is selected and is used to determined payoffs. We will now explain how the interface will produce a hint for you and the participant you are matched with.

Stage 3: Read the statements between quotes. Do not read statements between brackets.

"Now I will start the server. Please do not click anywhere until I ask you to." [start intro.ztt] [Figure A.4 shows what participants would see on their screens]

"On the left side of the screen you can see the distributions from which the hint is drawn, as we read in the instructions. If the coin toss is Tails, the Hint will be drawn from the green distribution. If the coin toss is Heads, the Hint will be drawn from the blue distribution. Please do not click on move on just yet. When you click on Move On the interface will present you with a few questions related to the information we just read

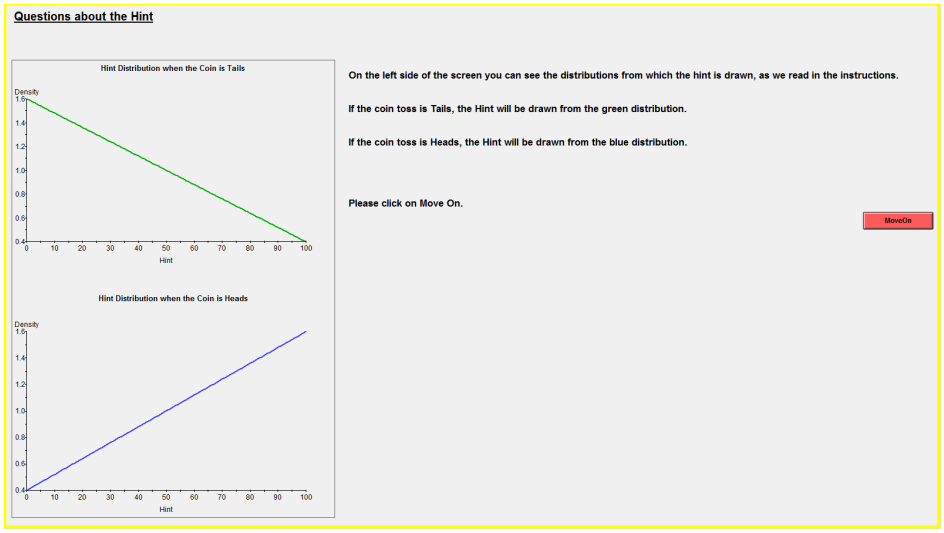


FIGURE A.4. Initial Screen for Stage 3

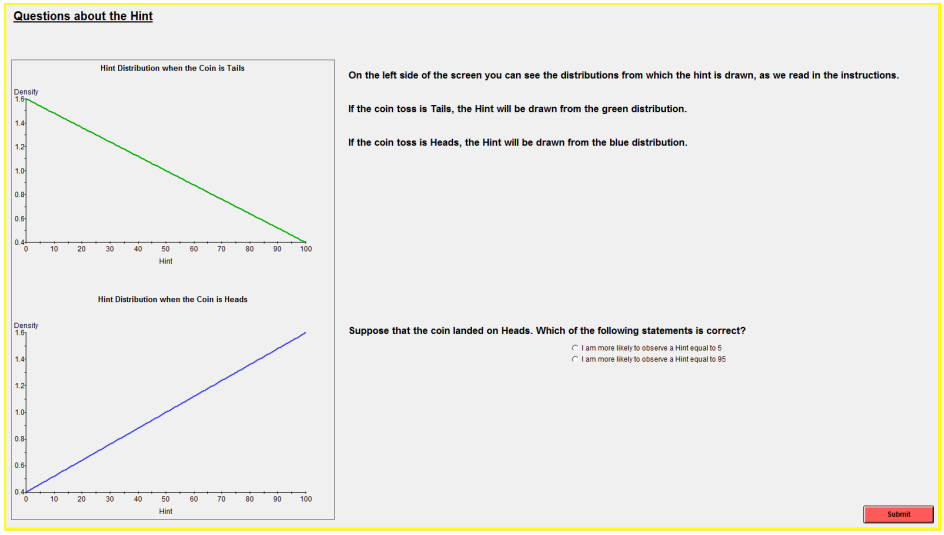


FIGURE A.5. Stage 3 after clicking on "Move on" on the Initial Screen

about how the hint is determined. If your answer is correct, the interface will move on to a new question. If you answer is incorrect, the interface will let you know and will ask you to answer again. You can now click on Move On. We will wait until all participants have finished." [Once all participants finish]

[Figures A.5-A.9 show what participants would see on their screens as they move at their own pace.]

"Are there any questions?"

Stage 4: Explain participants how to use the interface. Start Practice.ztt

Read the following script except the information between brackets.

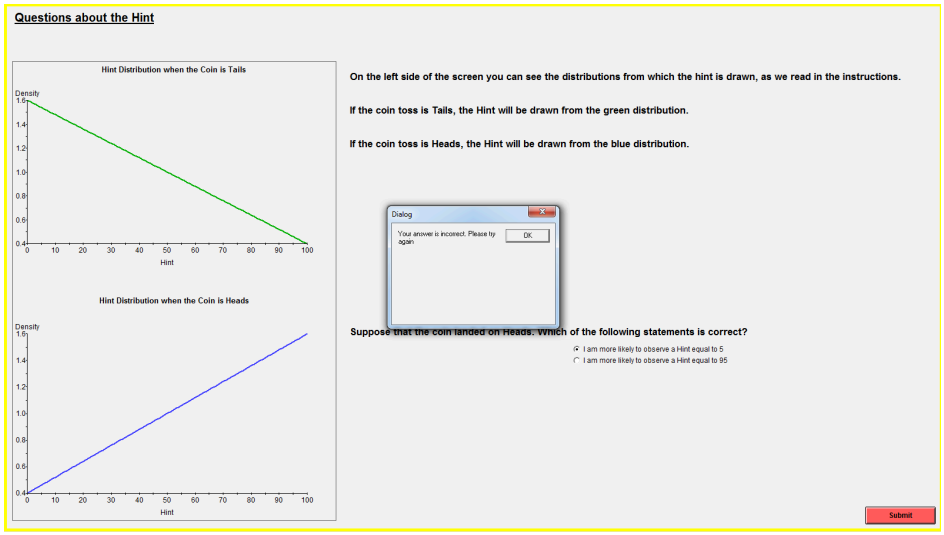


FIGURE A.6. Stage 3 subsequent screen if the answer is incorrect

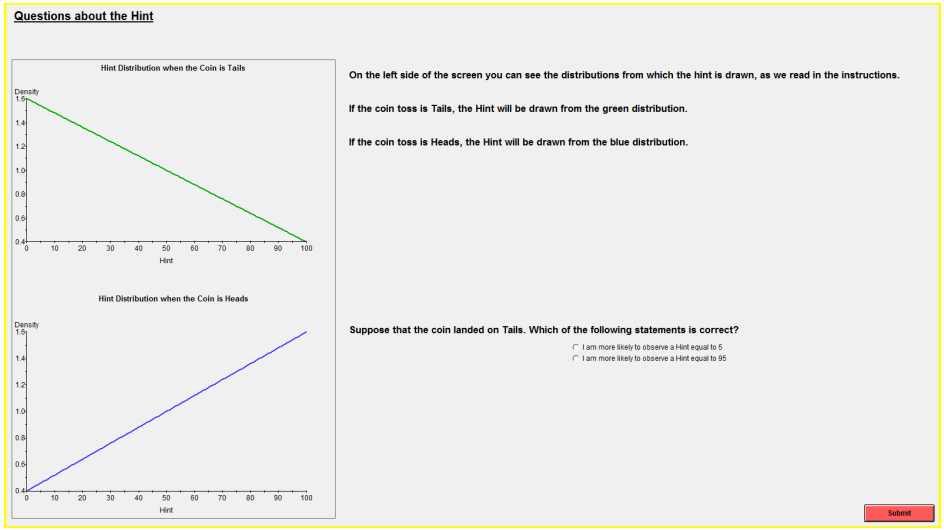


FIGURE A.7. Stage 3 subsequent screen if the answer is correct. They face a new question

"I just started the interface. Please do not click anywhere until I ask you to. I will now explain how to use the interface. What you do during this explanation period will not count for money, it is just meant to explain how to use the interface."

[Figure A.10 shows what participants would see on their screens]

At the top left of your screen you can see the Round number. Since this would be the first round, the round number is 1. On the left side of the screen you can see the distributions from which the hint will be drawn.

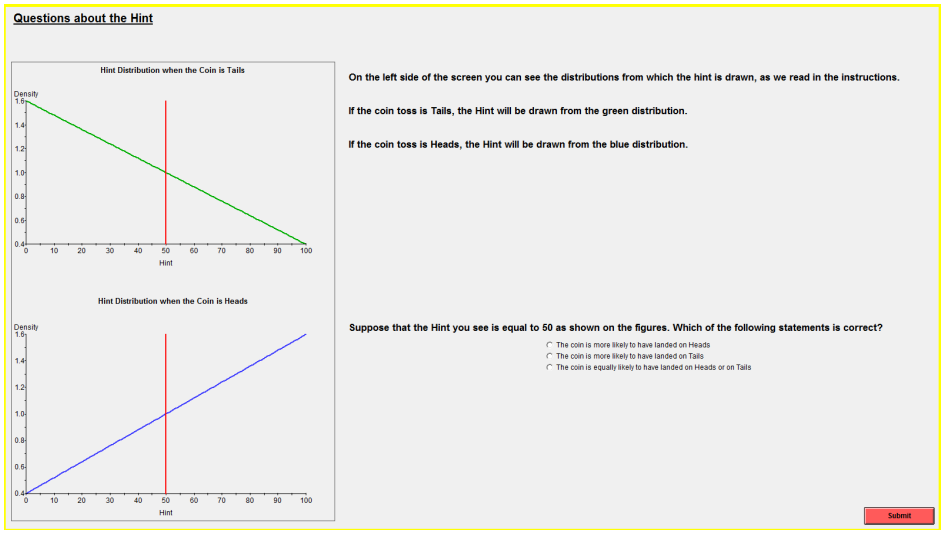


FIGURE A.8. Stage 3 subsequent screen if the answer is correct. They face a new question

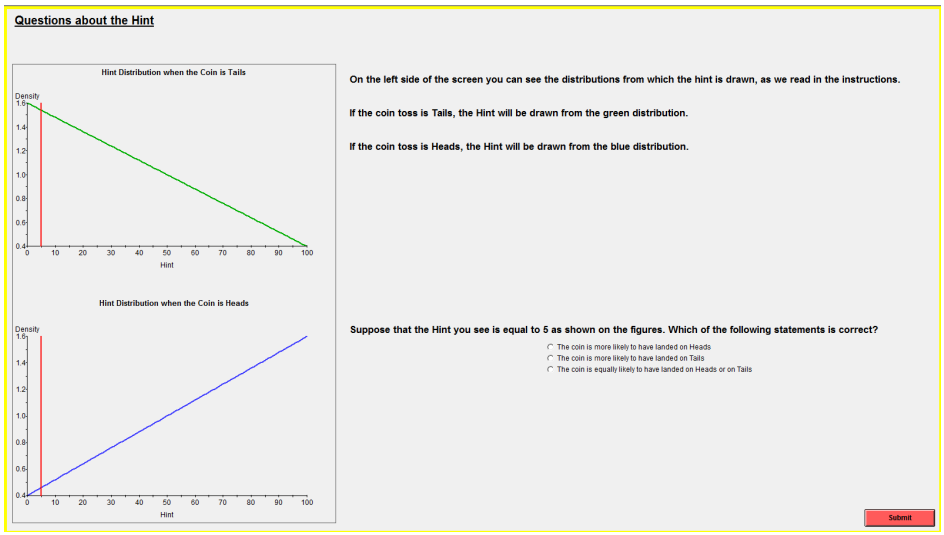


FIGURE A.9. Stage 3 subsequent screen if the answer is correct. They face a new question

Notice that on the right side of the screen, the interface already informs you that a coin was tossed for the round. This is explicitly on the screen as: 'Step 1: A coin was already tossed for this round. You do not know if it landed on Heads or Tails.'

Please do not click on the red button yet. When I ask you to click on the button the interface will randomly draw a hint, which constitutes Step 2. If the coin toss landed on Heads, it will select a Hint using the blue distribution. If the coin toss landed on Tails, it will select a Hint using the green distribution. Now please click on the Get Hint button.

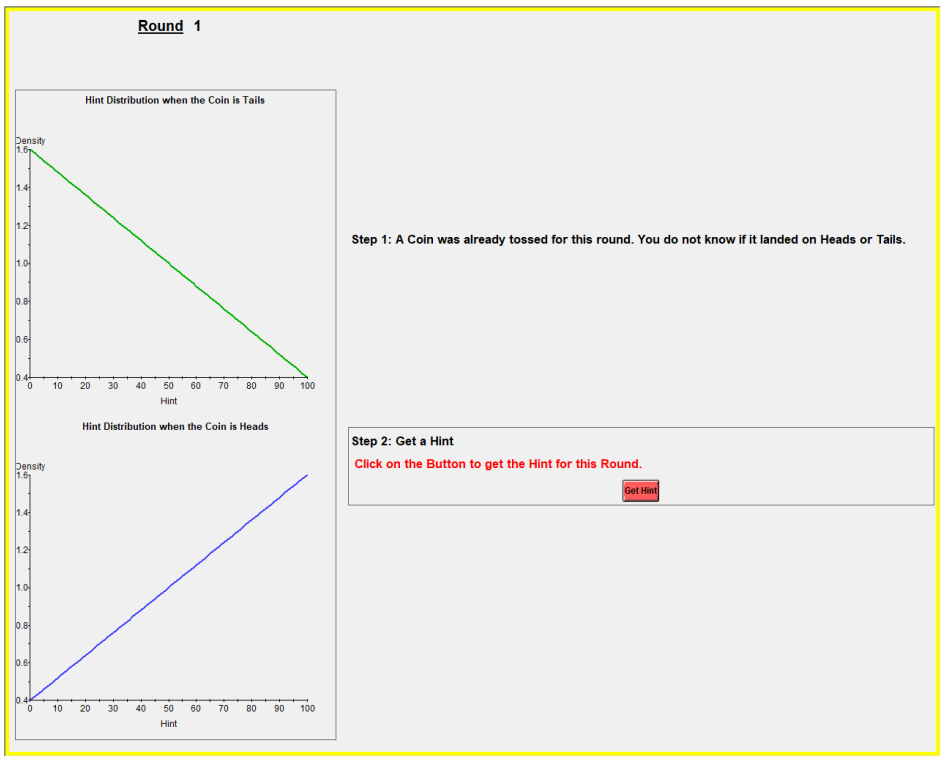


FIGURE A.10

"Is there anybody who hasn't yet clicked on the Get Hint button?" [If nobody raises their hand, continue reading. Otherwise, ask the person(s) to click on Get Hint.] "Now you can see your Hint for the Round. You can see it as a number in the Step 2 box. Notice that the figures also show the Hint, as a red line."

[Figure A.11 shows what participants would see on their screens]

"After you have seen the hint, your choice in Step 3 is whether to Talk or Listen. Please do not click anywhere. Recall that if you select Talk and your choice is implemented, the participant you are paired with will see your Hint. If you select Listen and your choice is implemented, you will see the Hint of the participant you're paired with. In order to make a choice, simply click on top of 'Talk' or 'Listen.' Once you click on one alternative, the alternative you select will be highlighted. You can change your choice as long as you don't click on the submit button. Once you click on the submit button your decision is final. Please click on "Talk" or "Listen" and then click on the submit button. Recall that your choice does not count for money.

At the top-right of your current screen you can see a summary of steps 1-3. You can see your Hint and your choice. In Step 4, you ask the interface to see the Die roll that decides the choice that is implemented." [Figure A.12 shows what participants would see on their screens] "Recall that:

- If the die shows a 1 or a 2, then your choice is implemented:
  - You decided to talk: The other participant observes your hint.

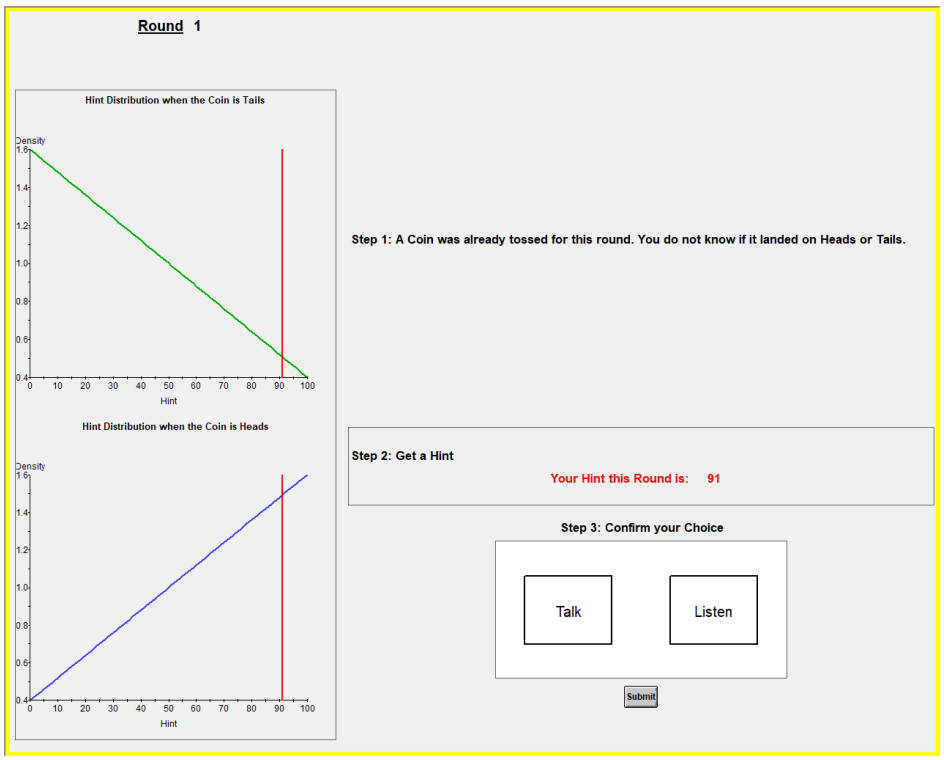


FIGURE A.11

  - You decided to listen: You observe the other participant's hint.

- If the die shows a 3 or a 4, then the other participant's choice is implemented:
  - The other participant decided to talk: You observe the other participant's hint.
  - The other participant decided to listen: The other participant observes your hint.
- If the die shows a 5, you will talk for sure: The other participant observes your hint.
- If the die shows a 6, you will listen for sure: You observe the other participant's hint."

"Now please click on Get Die" [Figure A.13 shows what participants would see on their screens] "The next screen shows the outcome of the die. In the example, the die resulted in number 5, so you will talk for sure. The participant you are paired with will observe your hint.

If the outcome had been one where you get to observe the other's hint, then a second vertical red line would appear in the figures on the left side exactly at the Hint of the other participant. In addition, in the Step 4 box you would also be informed of the other's hint.

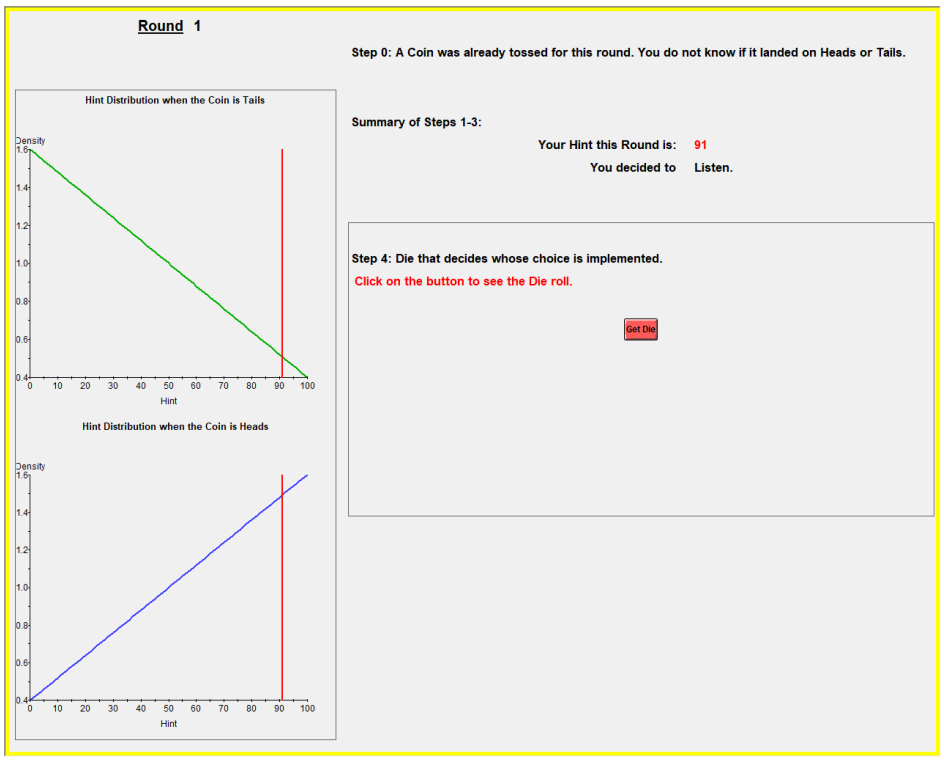


FIGURE A.12

Please now click on Move On." [The software for the instruction period is coded so that the die results in #5 to everybody so that nobody gets to observe the hint of the other person. All participants are then in an equal position from the perspective of what they have learnt in the instruction period.]

[Figure A.14 shows what participants would see next]

"In Step 5, your task is to submit a report. You select a number between 0 and 100 that indicates how likely you think that the coin flip was Heads. A report of 0 means that you're sure that the coin landed on Tails. A report of 100 means that you're sure that the coin landed on Heads. When you are making choices for money, recall that the payment rule is purposefully designed so that you have the greatest chance of winning $20 when your report is indeed your true assessment on how likely it is that the coin toss was Heads.

Your choice during this period will not count for money. Please enter a number between 0 and 100 and click on submit."

"When you are making choices for money, after you click on the submit button you will receive full feedback. You will be reminded of your hint, whether you chose to Talk or Listen and your report on the likelihood that the coin landed on Heads. You will be shown the hint of the other, whether the other decided to talk or listen and the other's report. You will also be shown which of the two reports was selected for payment and you will also be told if the coin toss was Heads or Tails for the round. Finally, the feedback screen will also show you the payoff you would receive if the round was selected for payment.

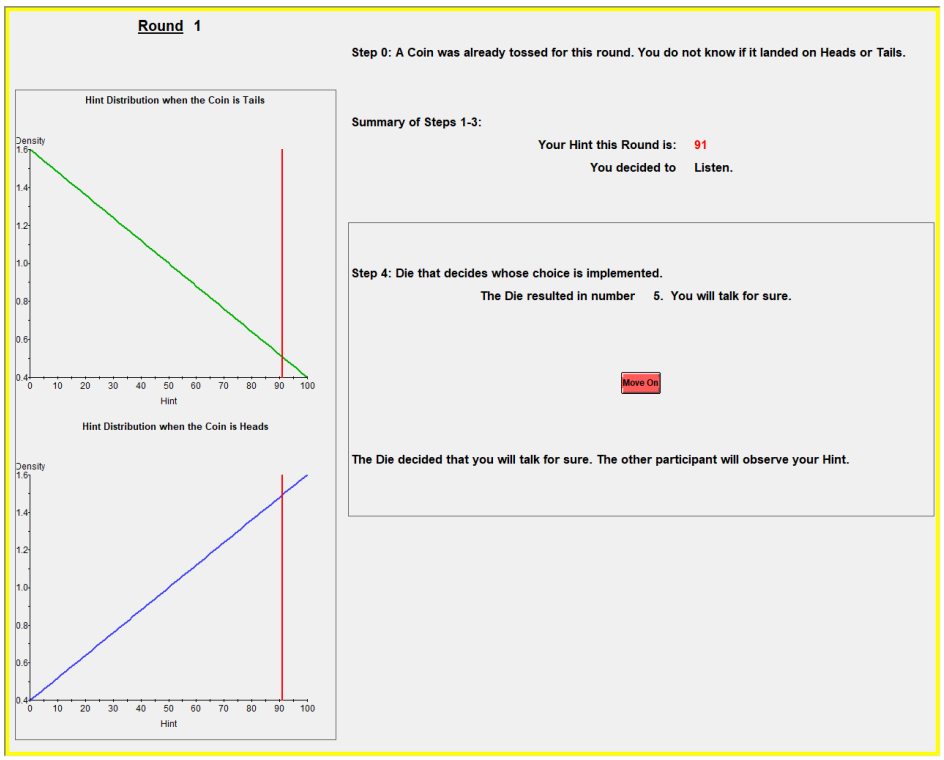


FIGURE A.13

Are there any questions?

You will now start with Part 1. Part 1 consists of 5 rounds. In each round, you are randomly matched with another person in the room."

Stage 5: Start Part 1. Start Abstract.ztt. Participants go over the 5 rounds of Part 1. The instructions do not present subjects with the feedback screen they will observe at the end of each round because we do not want to provide them with any data from others that would affect their play. For completion, Figure A.15 presents a screenshot of an example for the feedback at the end of the round.

Stage 6: Beginning of Part 2, explain how to use the threshold. Start Practice2.ztt. Read the text between quotes, avoid text between brackets.

"Please do not click anywhere. We now start with Part 2 of the experiment, which consists of 25 rounds that are identical to the rounds of part 1 except that the interface will provide you with an alternative way to submit your choices. I will explain how you make your choices in part 2. During this explanation period your choices will not count for money." [Figure A.16 shows what participants would see on their screens]

"On the left side of your screens you have the same information that you have seen in part 1.

Step 0 has taken place and a coin has been tossed. The main difference between part 1 and part 2 is that now the interface asks you to submit a threshold that will determine

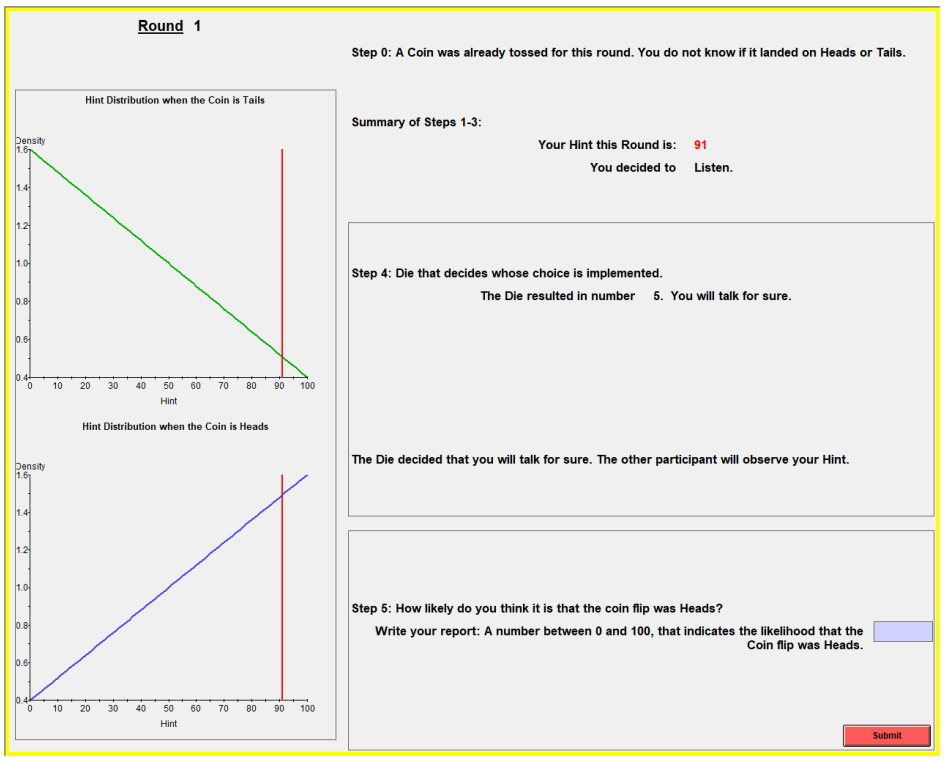


FIGURE A.14

your choice to talk or listen before you observe the Hint for the round. I will now explain how you submit a threshold for your choices.

Notice that in the Step 1 box there is a line with number 0 on the left and number 100 on the right. Think of this line as representing all integers from 0 to 100. You select a threshold by clicking anywhere in the box.

Now please click once inside of the box and do not click again. [Figure A.17 shows what participants would see on their screens.] As you clicked on the box a number of objects appeared in the box. I will explain each of them. First look at the red bars. The red bars correspond to your threshold.

"Focus on the left-most red bar, the one with the lowest red number. What this threshold indicates is that if you were to receive a Hint that is equal to the lowest red number or anything lower than that, then you would want to talk. Numbers that are lower than or equal to the lowest red number are indicated with the left-most orange arrow.

Focus now on the right-most red bar, the one with the highest red number. What this threshold indicates is that if you were to receive a Hint that is higher than or equal to the highest red number, you would want to talk. Numbers that are lower than or equal to the highest red number are indicated with the right-most orange arrow.

For numbers that are in between the two thresholds, that is for Hints higher than the lowest red number, but lower than the highest red number, thresholds indicate that you would like to Listen.

FIGURE A.15

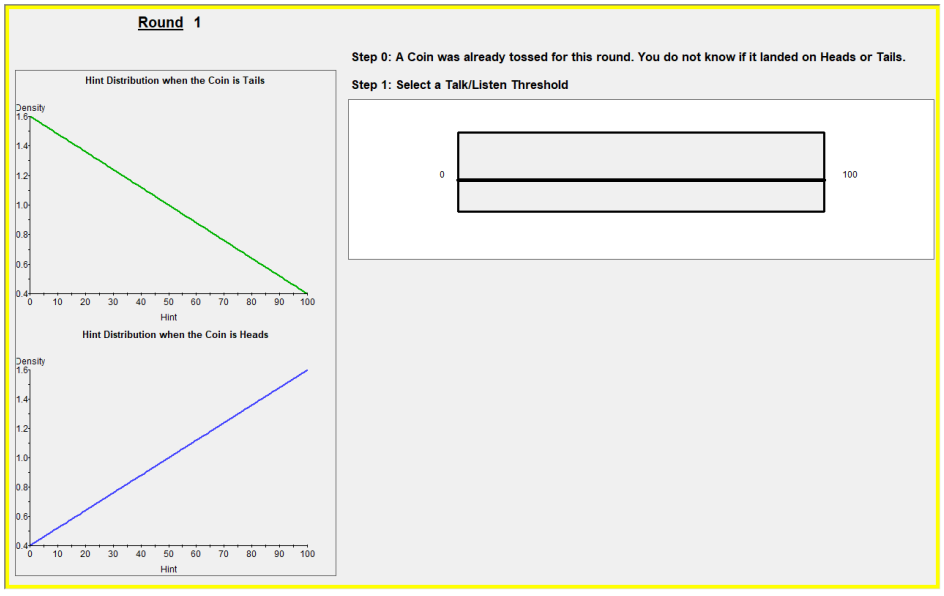


FIGURE A.16

The idea behind the thresholds is the following. For very high numbers or very low numbers, your hint would be more informative of the coin toss and you may want the other participant to see your Hint (Talk). For numbers in the middle, your hint would not be

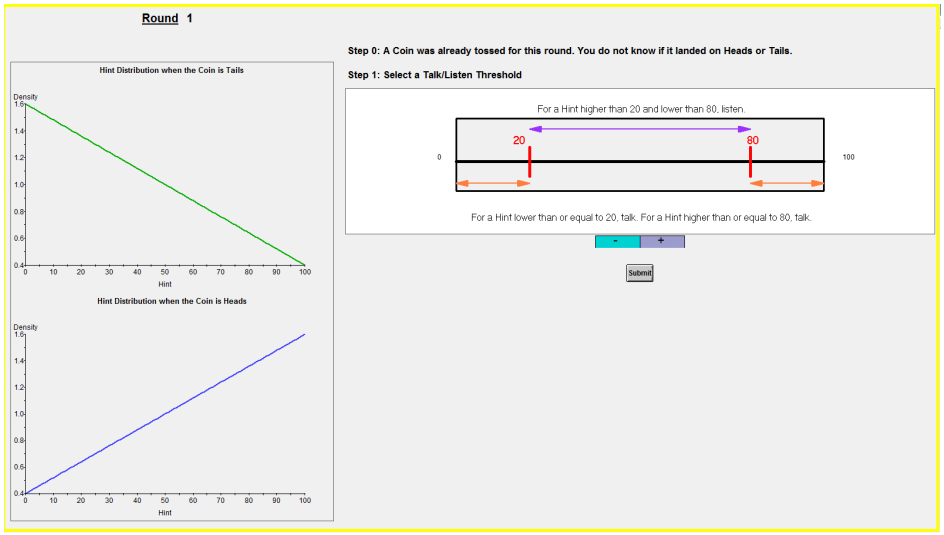


FIGURE A.17

very informative of the coin toss and you may want to see the hint that the other participant received (Listen). What you can choose is where exactly to place your thresholds.

You can change your choice by clicking anywhere else in the line. You can also use the +/- buttons at the bottom. Each time you click on +, you add one unit to the number that corresponds to the lower threshold. Each time you click on – you subtract one unit from the number that corresponds to the lower threshold.

The software imposes that your thresholds are symmetric, so if you get the lower threshold closer to 0 by one unit, the upper threshold will get closer to 100 by one unit as well.

You can now go ahead and change your current choice by clicking elsewhere along the 0-100 line. Please also try using the +/- buttons. Are there any questions?

You can change your choice as long as you don't click on the submit button button, but once you click on the submit button, your choice is final.

Now please click on the submit button." [Figure A.18 shows what participants would see on their screens]

"After you submit your threshold, you move on to Step 2, in which you will receive your Hint for the round. Please click on Get Hint."

[Figure A.19 shows what participants would see on their screens]

"Now you can see your hint and you can decide Talk/Listen just as you did in Part 1. If your choice of Talk/Listen is not consistent with your choice of Step 1 threshold, the interface will inform you that your choice was not consistent and will ask you to modify your choice so that it is consistent with the threshold.

For example, suppose that after you observe the Hint you select to Talk. If for that Hint, your threshold indicates that you would have wanted to Listen, the interface will ask you

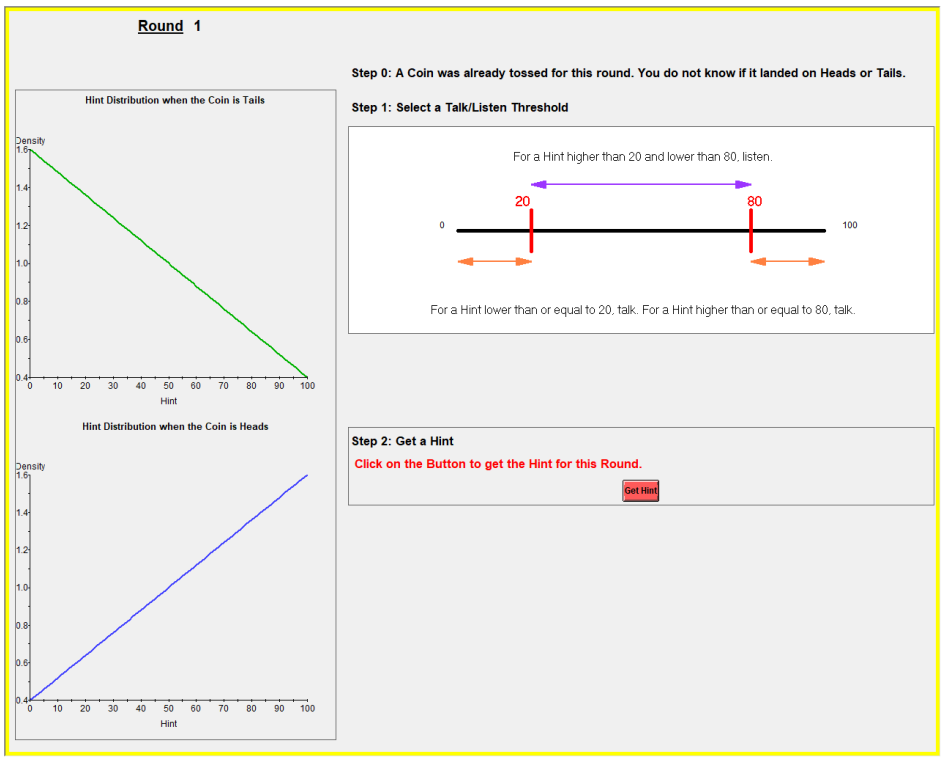


FIGURE A.18

to modify your choice and to select Listen. Next round when you are selecting a threshold you can modify your choice of threshold if you wanted to.

Once your choice Talk/Listen is consistent with your threshold when you press on Submit you will move on to observing whose choice is implemented for the round just as you did in part 1. From now on there are no changes in part 2 and the following steps look exactly as you did in part 1. When you click on the submit button this explanation period will be over."

"We will now start with Part 2. Part 2 consists of 25 rounds. In each round you are randomly matched with another person in the room. Once the 25th round is over, the session will end."

Stage 7: Once the session is over, the software informs subjects on their screen of their earnings. The experimenter pays the subjects their earnings, they sign the receipt and are free to leave the laboratory.

D.2. **Protocol for Conducting an Asymmetric Abstract-Design Session.** We now present the protocol for conducting an asymmetric abstract-design session, which consists of 8 stages.

Stage 0: An even number of subjects enters the laboratory. Subjects sign consent forms. Collect consent forms.

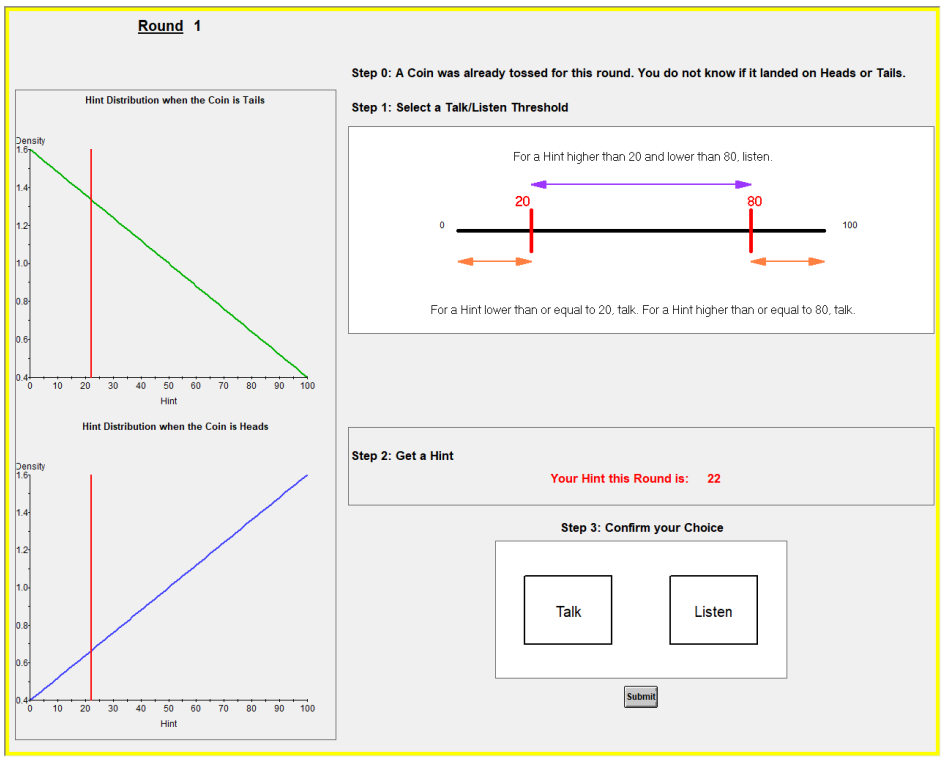


FIGURE A.19

Stage 1: Start server and ztree in all computers. Set up ztree in the background. Start Powerpoint in the server. Open file Instructions.ppt. (*One slide, reproduced as Figure A.3*) Read the slide.

Stage 2: Distribute instructions in paper. Read instructions. The instructions are omitted here as they identical as for the symmetric abstract-design session.

Stage 3: Explain to participants how to use the interface. Read the statements between quotes. Do not read statements between brackets.

"Now I will start the server. Please do not click anywhere until I ask you to." [start introAsy.ztt] [Figure A.20 shows what participants would see on their screens]

"On the left side of the screen at the top you can see the distributions from which the hint is drawn if your Type is A, and at the bottom the distributions if your Type is B. If the coin toss is Tails and your Type is A, the Hint will be drawn from the top green distribution. If the coin toss is Heads and your Type is A, the Hint will be drawn from the top blue distribution. If the coin toss is Tails and your Type is B, the Hint will be drawn from the bottom green distribution. If the coin toss is Heads and your Type is B, the Hint will be drawn from the bottom blue distribution. Please do not click on move on just yet. When you click on Move On the interface will present you with a few questions related to the information we just read about how the hint is determined. If your answer is correct, the interface will move on to a new question. If you answer is incorrect, the interface will let

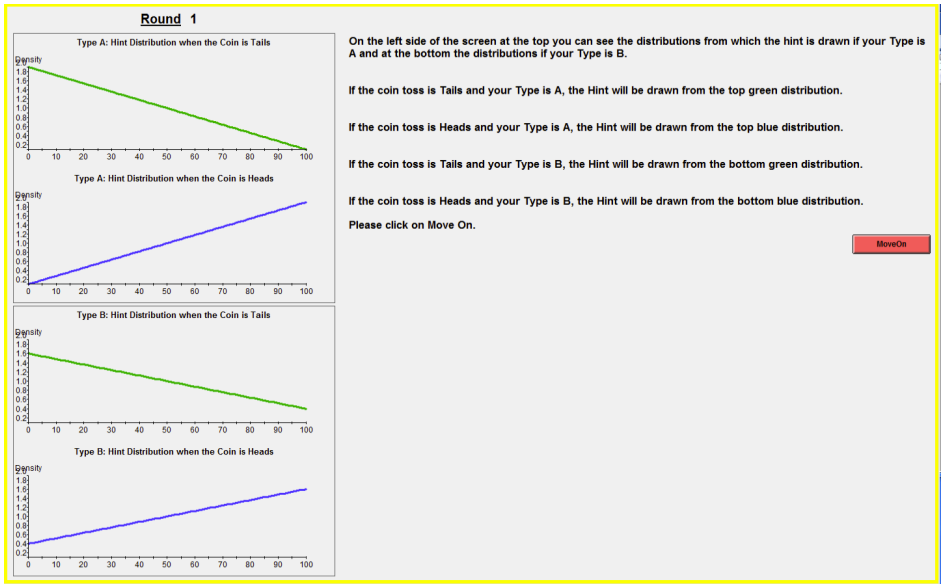


FIGURE A.20. Initial Screen for Stage 3

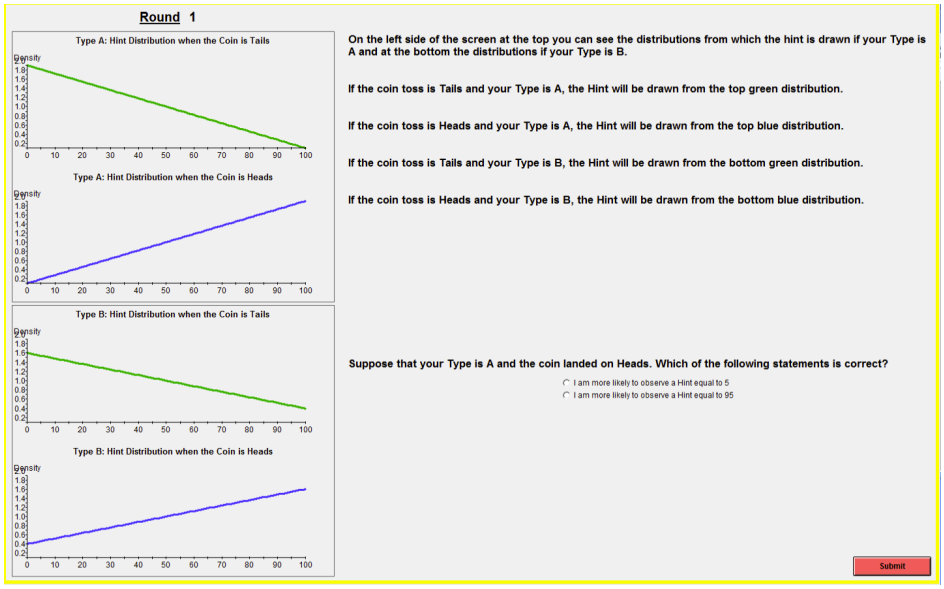


FIGURE A.21. Stage 3 after clicking on "Move on" on the Initial Screen

you know and will ask you to answer again. You can now click on Move On. We will wait until all participants have finished." [Once all participants finish]

[Figures A.21-A.32 show what participants would see on their screens as they move at their own pace. If they answer any question incorrectly, they are asked to answer again.]

"Are there any questions?"

Stage 4: Explain participants how to use the interface. Start PracticeAsy.ztt

Read the following script ignoring the information between brackets.

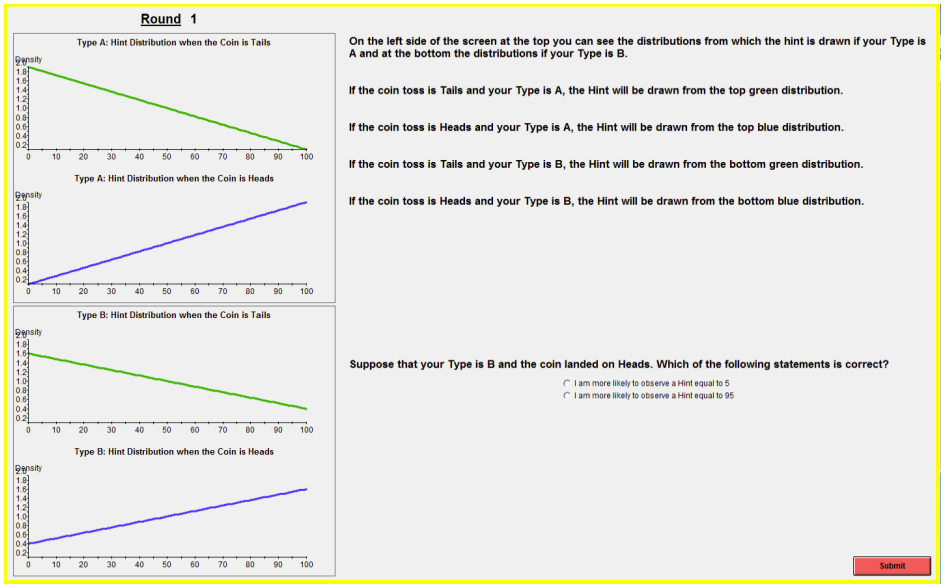


FIGURE A.22. Stage 3 subsequent screen if the answer is correct. They face a new question

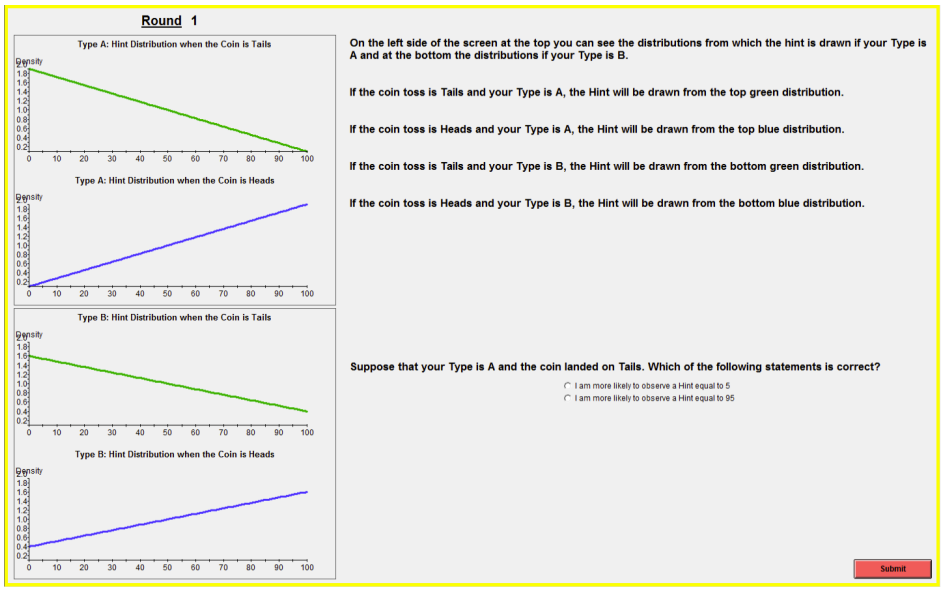


FIGURE A.23. Stage 3 subsequent screen if the answer is correct. They face a new question

"I just started the interface. Please do not click anywhere until I ask you to. I will now explain how to use the interface. What you do during this explanation period will not count for money, it is just meant to explain how to use the interface."

[Figure A.33 shows what participants would see on their screens]

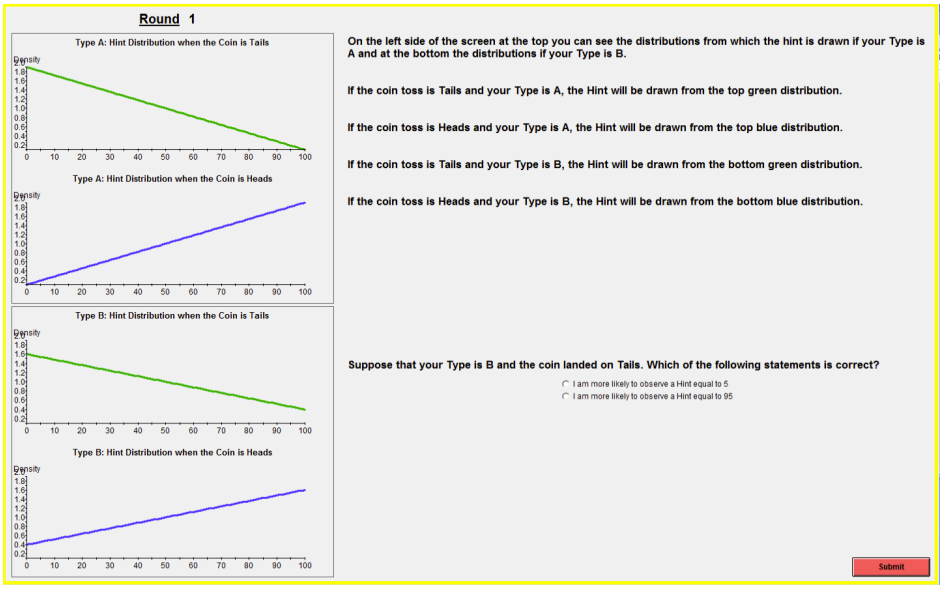


FIGURE A.24. Stage 3 subsequent screen if the answer is correct. They face a new question

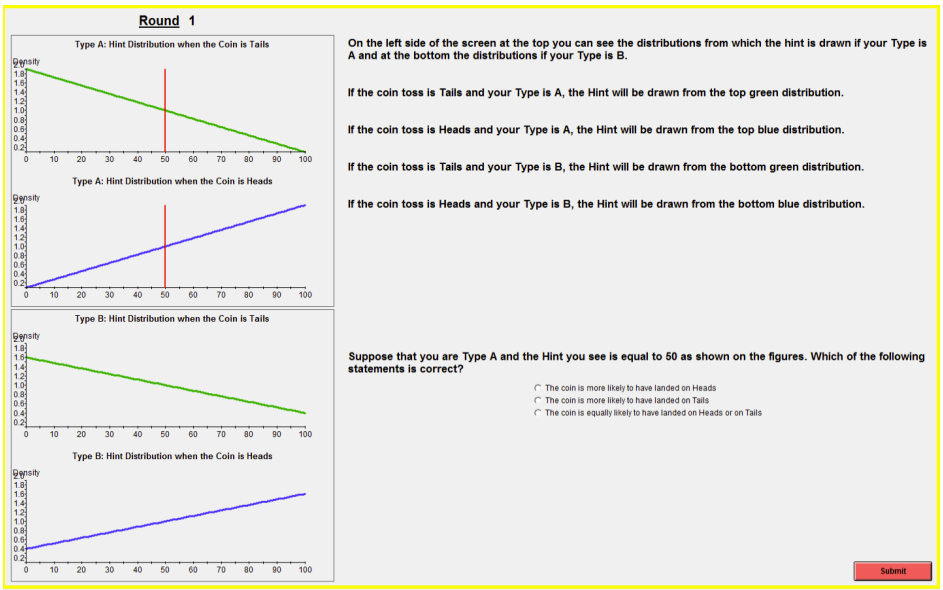


FIGURE A.25. Stage 3 subsequent screen if the answer is correct. They face a new question

"At the top left of your screen you can see the Round number. Since this would be the first round, the round number is 1. On the left side of the screen you can see the distributions from which the hint will be drawn. For this practice period we will explain the instructions as if all participants were assigned Type A. This is just for the instruction period. When you start Round 1 making choices for money you will learn if you were assigned Type A or Type B.

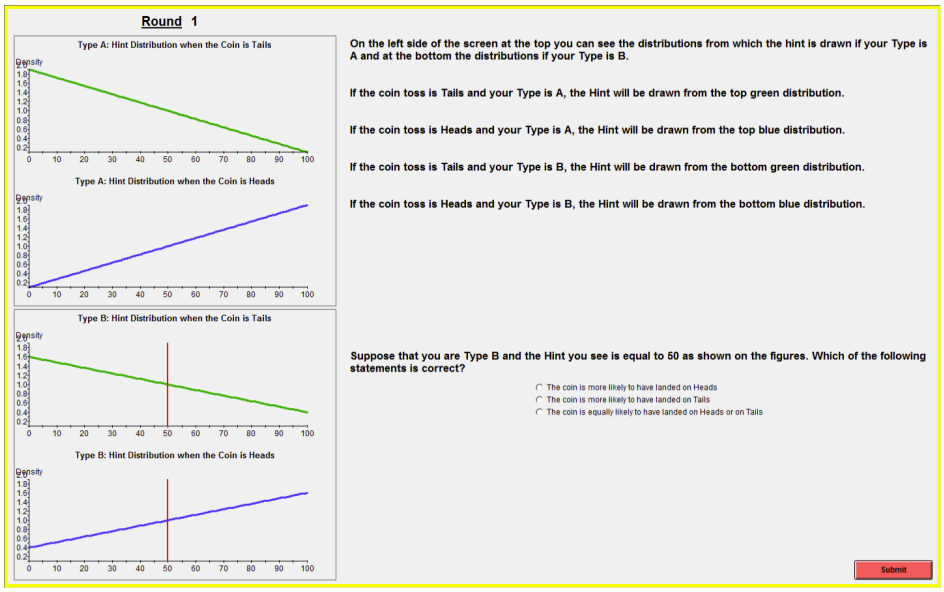


FIGURE A.26. Stage 3 subsequent screen if the answer is correct. They face a new question

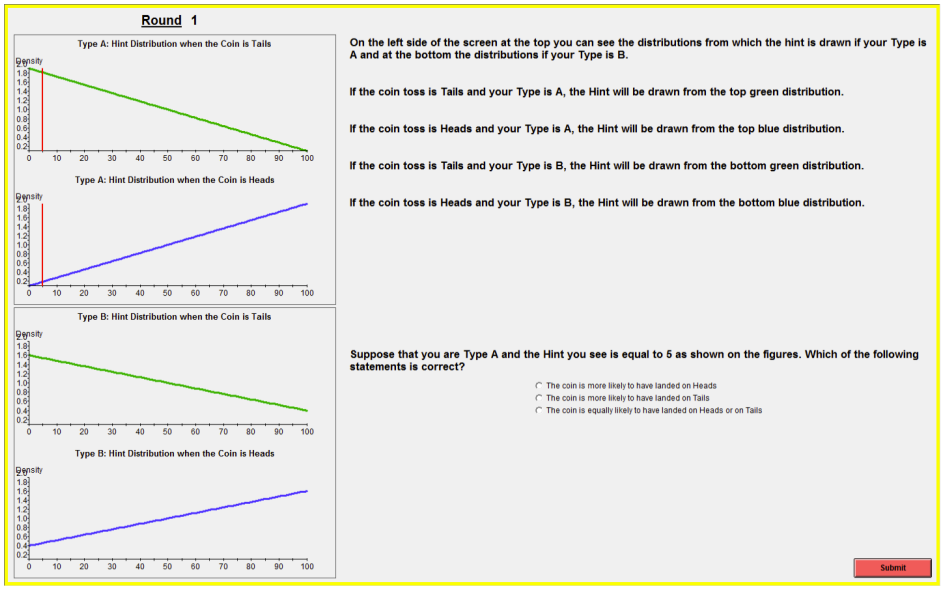


FIGURE A.27. Stage 3 subsequent screen if the answer is correct. They face a new question

Notice that on the right side of the screen, the interface already informs you that a coin was tossed for the round. This is explicitly on the screen as: 'Step 1: A coin was already tossed for this round. You do not know if it landed on Heads or Tails.'

Please do not click on the red button yet. When I ask you to click on the button the interface will randomly draw a hint, which constitutes Step 2. If the coin toss landed on Heads, it will select a Hint using the top blue distribution. If the coin toss landed

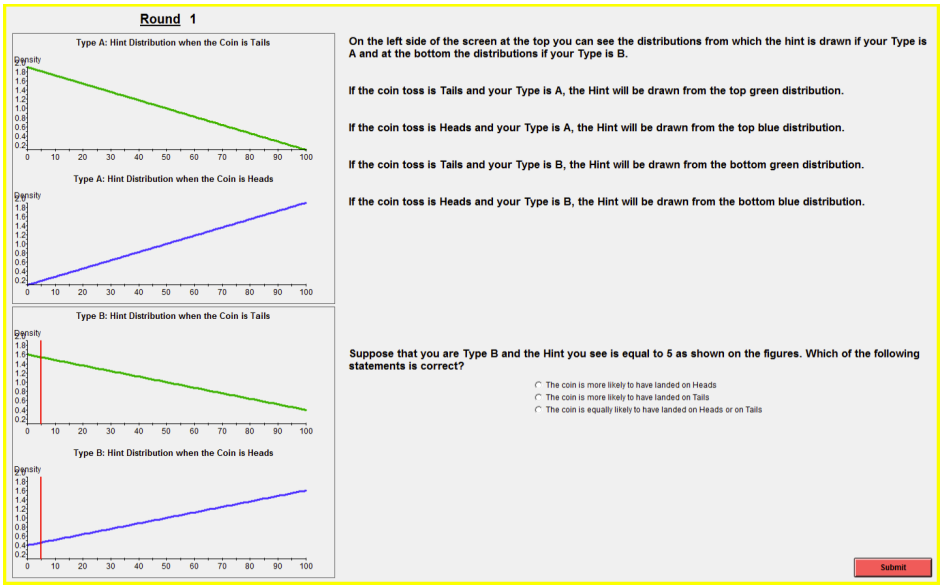


FIGURE A.28. Stage 3 subsequent screen if the answer is correct. They face a new question

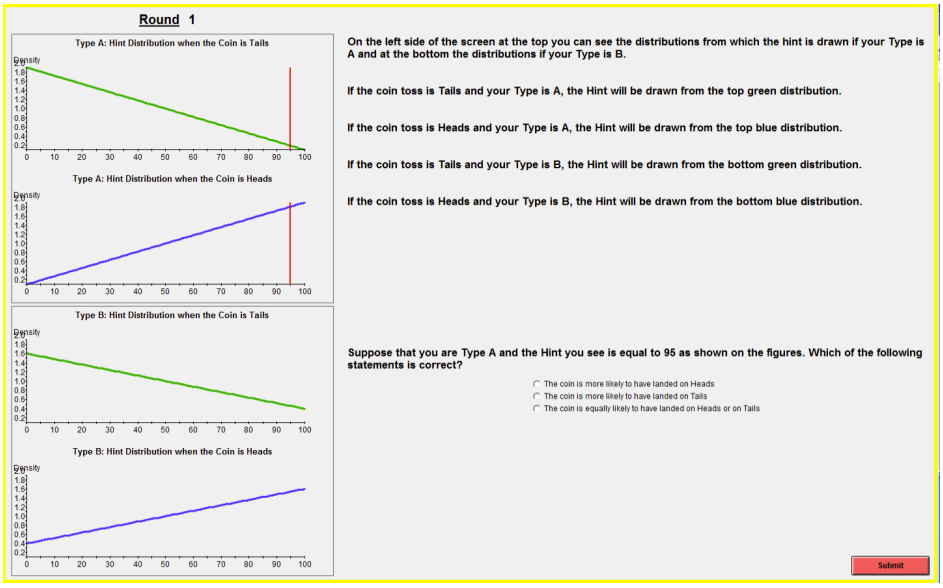


FIGURE A.29. Stage 3 subsequent screen if the answer is correct. They face a new question

on Tails, it will select a Hint using the top green distribution. The interface is using the top distributions because we're assuming that you were assigned Type A. If you had been assigned Type B, it would use the bottom distributions. Now please click on the Get Hint button."

"Is there anybody who hasn't yet clicked on the Get Hint button? [If nobody raises their hand, continue reading. Otherwise, ask the person(s) to click on Get Hint.] Now you can

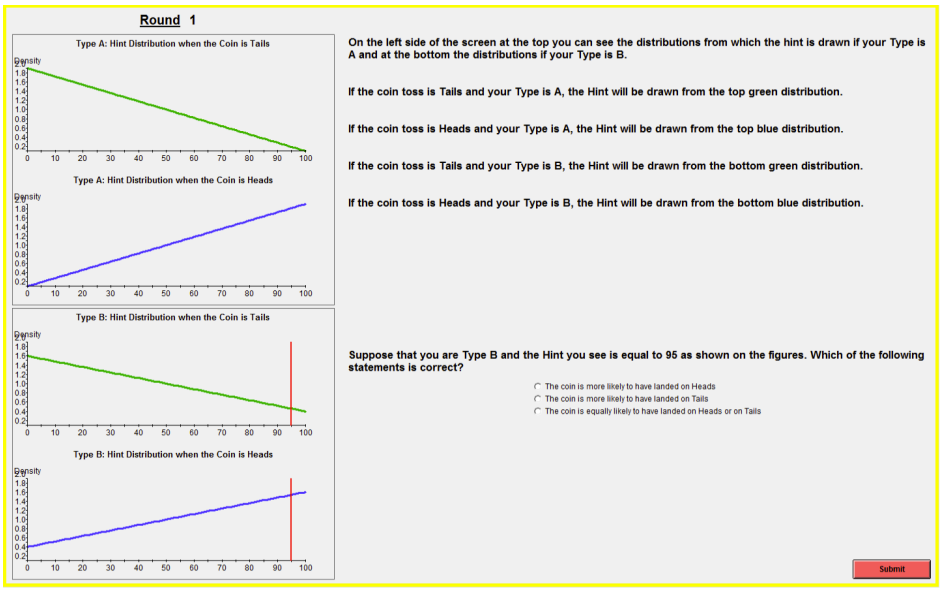


FIGURE A.30. Stage 3 subsequent screen if the answer is correct. They face a new question

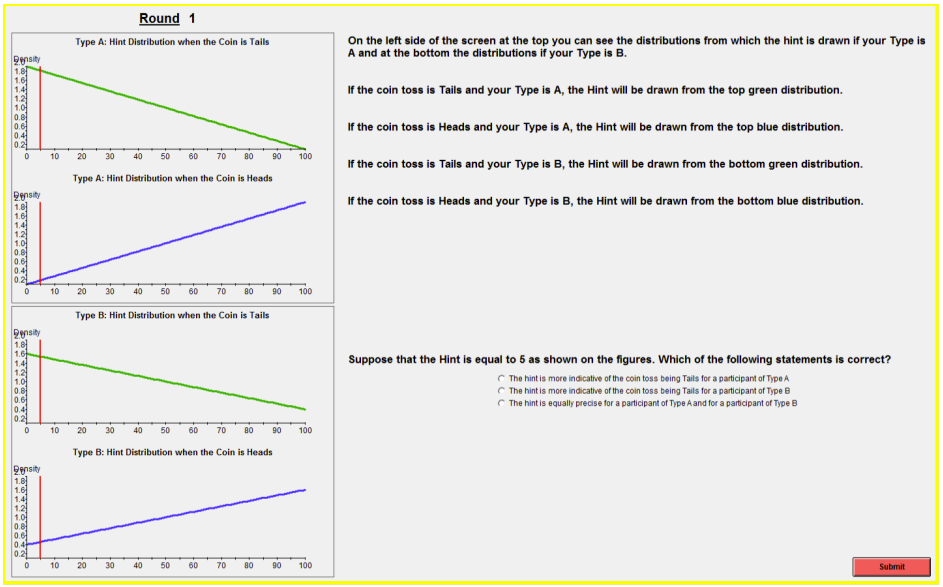


FIGURE A.31. Stage 3 subsequent screen if the answer is correct. They face a new question

see your Hint for the Round. You can see it as a number in the Step 2 box. Notice that the figures also show the Hint, as a red line on the top distributions. The line appears at the top distributions because we're assuming that you are Type A. If you had been assigned Type B, the red lines would appear on the bottom distributions."

[Figure A.34 shows what participants would see on their screens]

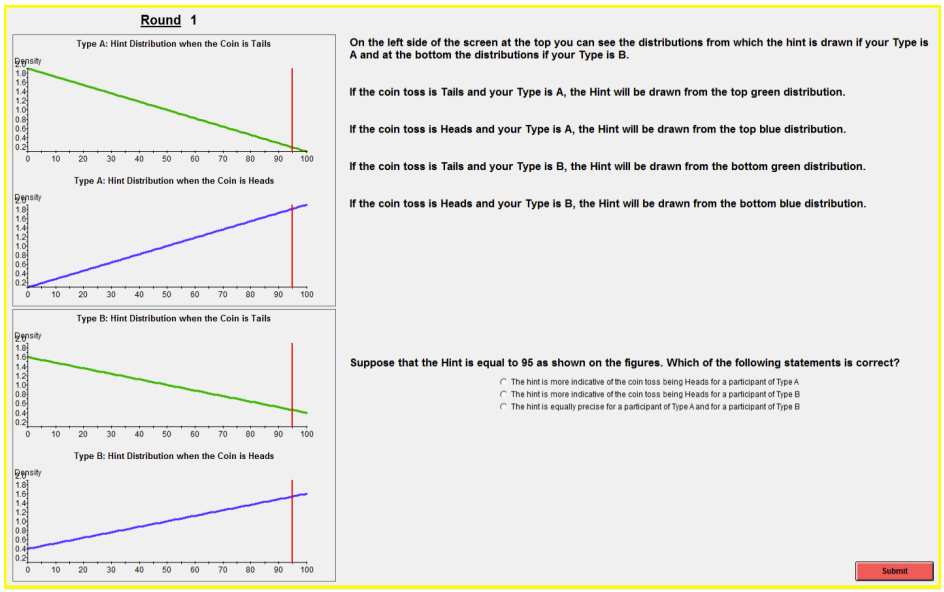


FIGURE A.32. Stage 3 subsequent screen if the answer is correct. They face a new question

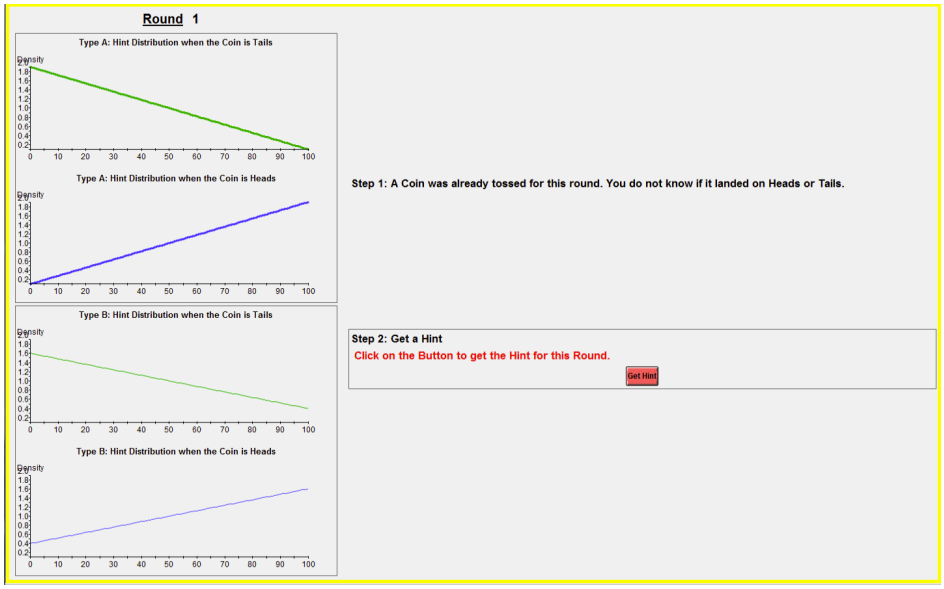


FIGURE A.33

"After you have seen the hint, your choice in Step 3 is whether to Talk or Listen. Please do not click anywhere. Recall that if you select Talk and your choice is implemented, the participant you are paired with will see your Hint. If you select Listen and your choice is implemented, you will see the Hint of the participant you're paired with. In order to make a choice, simply click on top of 'Talk' or 'Listen.' Once you click on one alternative, the alternative you select will be highlighted. You can change your choice as long as you don't click on the submit button. Once you click on the submit button your decision is

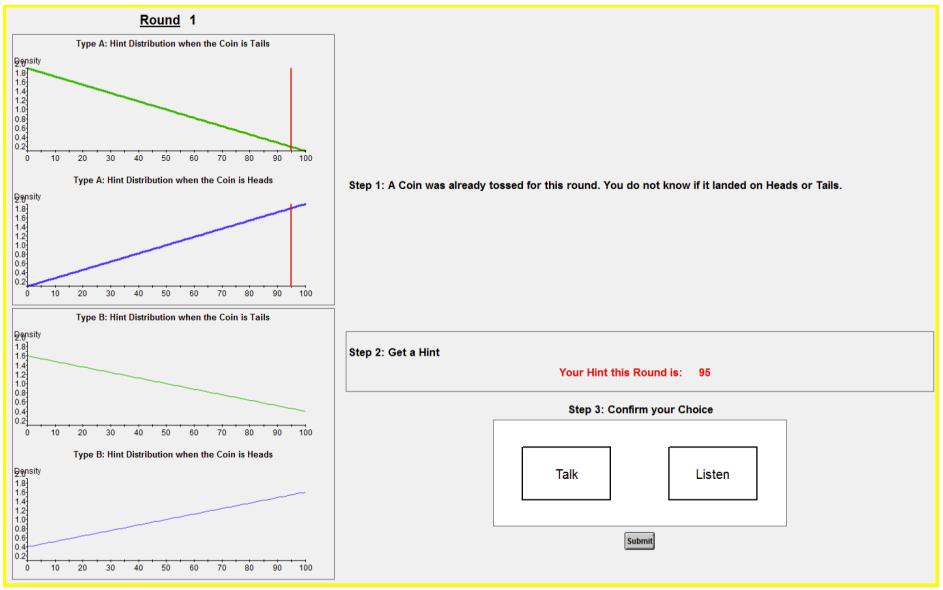


FIGURE A.34

final. Please click on "Talk" or "Listen" and then click on the submit button. Recall that your choice does not count for money.

At the top-right of your current screen you can see a summary of steps 1-3. You can see your Hint and your choice. In Step 4, you ask the interface to see the Die roll that decides the choice that is implemented." [Figure A.35 shows what participants would see on their screens] "Recall that:

- If the die shows a 1 or a 2, then your choice is implemented:
  - You decided to talk: The other participant observes your hint.
  - You decided to listen: You observe the other participant's hint.
- If the die shows a 3 or a 4, then the other participant's choice is implemented:
  - The other participant decided to talk: You observe the other participant's hint.
  - The other participant decided to listen: The other participant observes your hint.
- If the die shows a 5, you will talk for sure: The other participant observes your hint.
- If the die shows a 6, you will listen for sure: You observe the other participant's hint."

"Now please click on Get Die" [Figure A.36 shows what participants would see on their screens] "The next screen shows the outcome of the die. In the example, the die resulted in number 5, so you will talk for sure. The participant you are paired with will observe your hint.

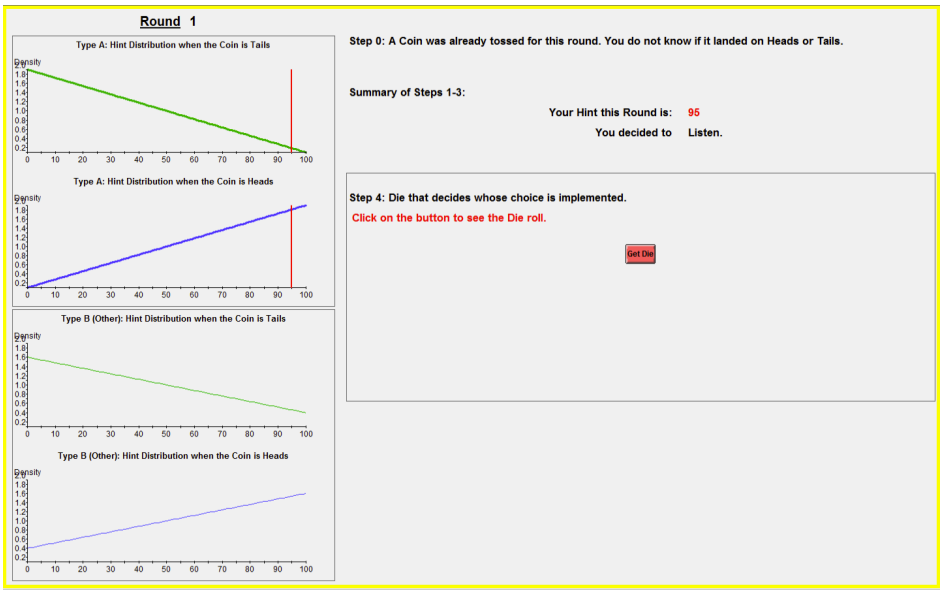


FIGURE A.35

If the outcome had been one where you get to observe the other's hint, then a second vertical red line would appear in the bottom figures exactly at the Hint of the other participant. This is because if we're assuming that you were assigned Type A, the other participant would have been assigned type B. If you had been assigned type B, then the other participant's hint would appear at the top distributions. In addition, in the Step 4 box you would also be informed of the other's hint.

Please now click on Move On." [The software for the instruction period is coded so that the die results in #5 to everybody so that nobody gets to observe the hint of the other person. All participants are then in an equal position from the perspective of what they have learnt in the instruction period.]

[Figure A.37 shows what participants would see next]

"In Step 5, your task is to submit a report. You select a number between 0 and 100 that indicates how likely you think that the coin flip was Heads. A report of 0 means that you're sure that the coin landed on Tails. A report of 100 means that you're sure that the coin landed on Heads. When you are making choices for money, recall that the payment rule is purposefully designed so that you have the greatest chance of winning $20 when your report is indeed your true assessment on how likely it is that the coin toss was Heads.

Your choice during this period will not count for money. Please enter a number between 0 and 100 and click on submit."

"When you are making choices for money, after you click on the submit button you will receive full feedback. You will be reminded of your hint, whether you chose to Talk or Listen and your report on the likelihood that the coin landed on Heads. You will be shown the hint of the other, whether the other decided to talk or listen and the other's report. You will also be shown which of the two reports was selected for payment and you will

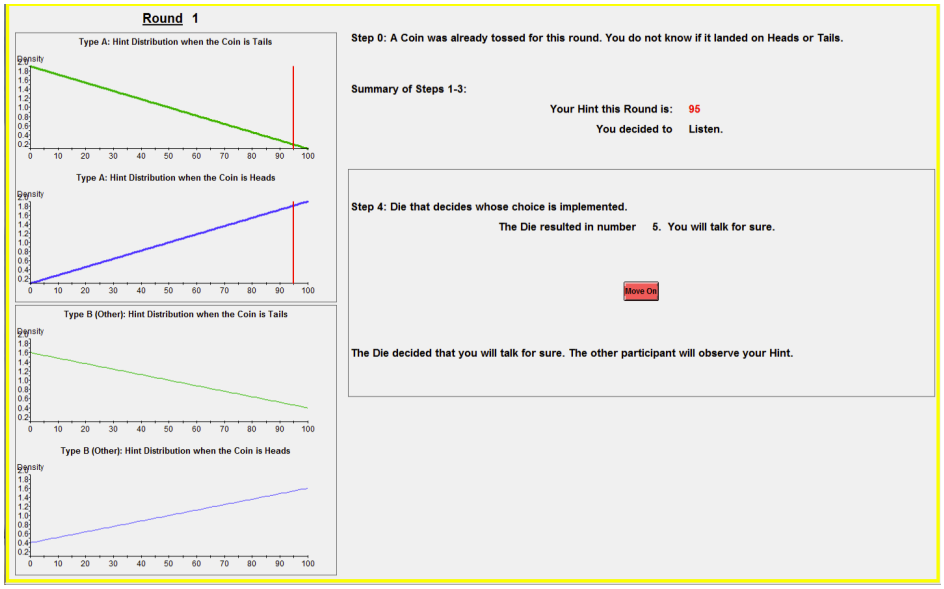


FIGURE A.36

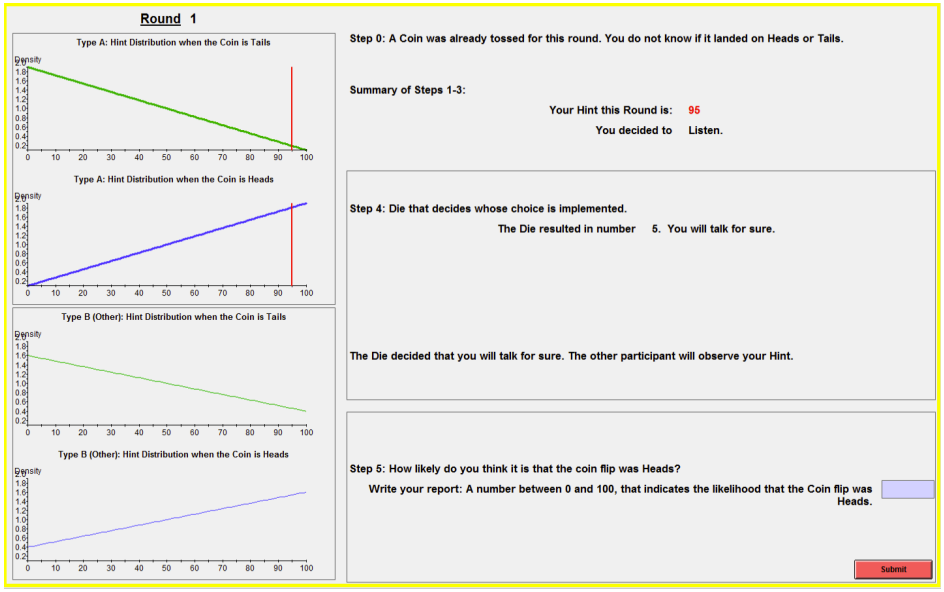


FIGURE A.37

also be told if the coin toss was Heads or Tails for the round. Finally, the feedback screen will also show you the payoff you would receive if the round was selected for payment.

Are there any questions?

You will now start with Part 1. Part 1 consists of 5 rounds. In each round, you are randomly matched with another person in the room."

Stage 5: Start Part 1. Start AbstractAsy.ztt. Participants go over the 5 rounds of Part 1. The instructions do not present subjects with the feedback screen they will observe at the

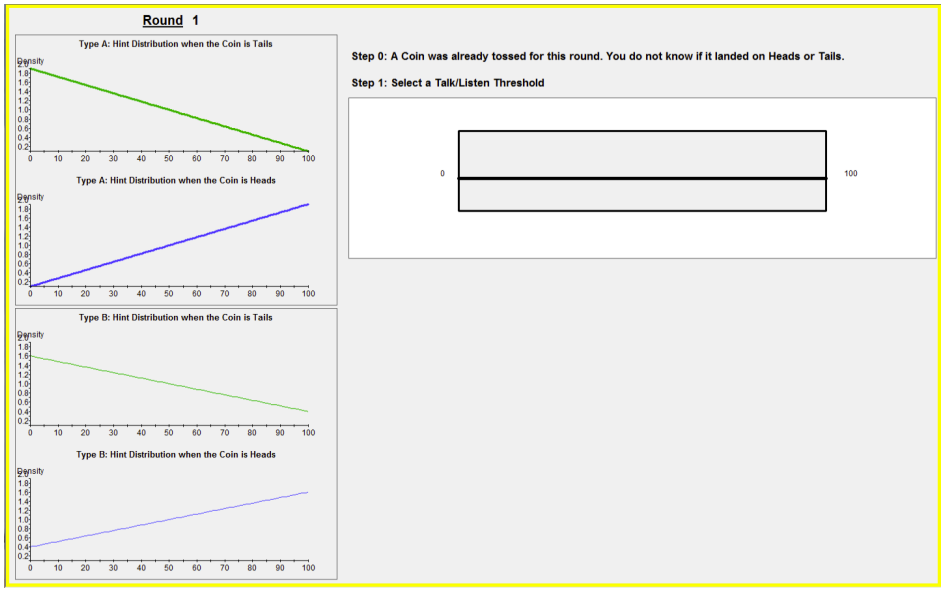


FIGURE A.38

end of each round because we do not want to provide them with any data from others that would affect their play. For completion, Figure A.15 presents a screenshot of an example for the feedback at the end of the round. Read the following statement: "Before you start I want to highlight that you can now learn the type that you are assigned. Please look at the distributions on the left side of your screens. The figures for type that you were assigned have the word "you" in all titles and the lines are presented in bold. The figures for the type that the other was assigned has the word "other" and are not presented in bold. Your type and the type just assigned to each participant will be fixed for the session."

Stage 6: Beginning of Part 2, explain how to use the threshold. Start Practice2.ztt. Read the text between quotes, avoid text between brackets.

"Please do not click anywhere. We now start with Part 2 of the experiment, which consists of 25 rounds that are identical to the rounds of part 1 except that the interface will provide you with an alternative way to submit your choices. I will explain how you make your choices in part 2. During this explanation period your choices will not count for money." [Figure A.38 shows what participants would see on their screens]

"On the left side of your screens you have the same information that you have seen in part 1. For this instruction period we will assume that you were assigned Type A, but the Type that you will have in part 2 is the same type you were assigned in part 1.

Step 0 has taken place and a coin has been tossed. The main difference between part 1 and part 2 is that now the interface asks you to submit a threshold that will determine your choice to talk or listen before you observe the Hint for the round. I will now explain how you submit a threshold for your choices.

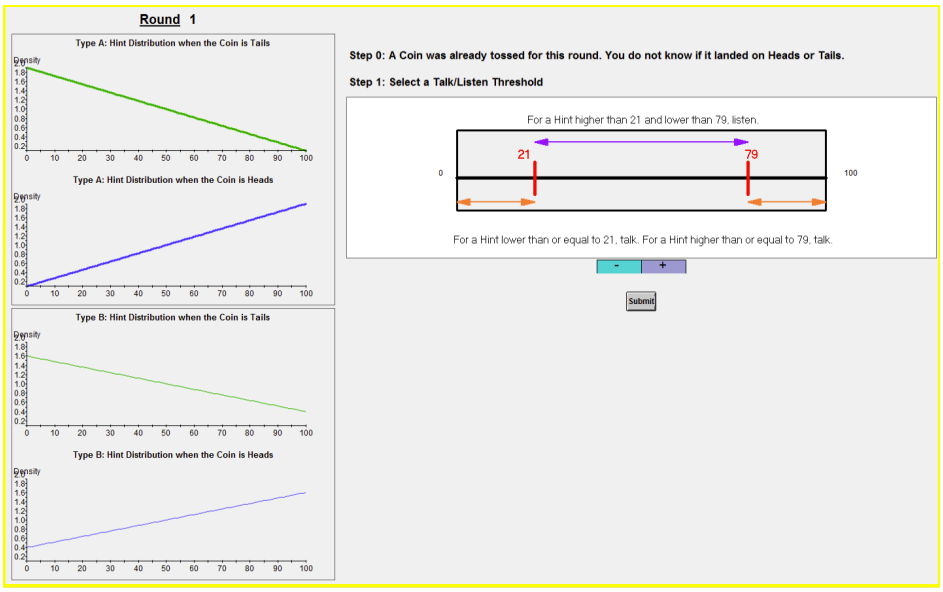


FIGURE A.39

Notice that in the Step 1 box there is a line with number 0 on the left and number 100 on the right. Think of this line as representing all integers from 0 to 100. You select a threshold by clicking anywhere in the box.

Now please click once inside of the box and do not click again. [Figure A.39 shows what participants would see on their screens.] As you clicked on the box a number of objects appeared in the box. I will explain each of them. First look at the red bars. The red bars correspond to your threshold.

"Focus on the left-most red bar, the one with the lowest red number. What this threshold indicates is that if you were to receive a Hint that is equal to the lowest red number or anything lower than that, then you would want to talk. Numbers that are lower than or equal to the lowest red number are indicated with the left-most orange arrow.

Focus now on the right-most red bar, the one with the highest red number. What this threshold indicates is that if you were to receive a Hint that is higher than or equal to the highest red number, you would want to talk. Numbers that are lower than or equal to the highest red number are indicated with the right-most orange arrow.

For numbers that are in between the two thresholds, that is for Hints higher than the lowest red number, but lower than the highest red number, thresholds indicate that you would like to Listen.

The idea behind the thresholds is the following. For very high numbers or very low numbers, your hint would be more informative of the coin toss and you may want the other participant to see your Hint (Talk). For numbers in the middle, your hint would not be very informative of the coin toss and you may want to see the hint that the other participant received (Listen). What you can choose is where exactly to place your thresholds.

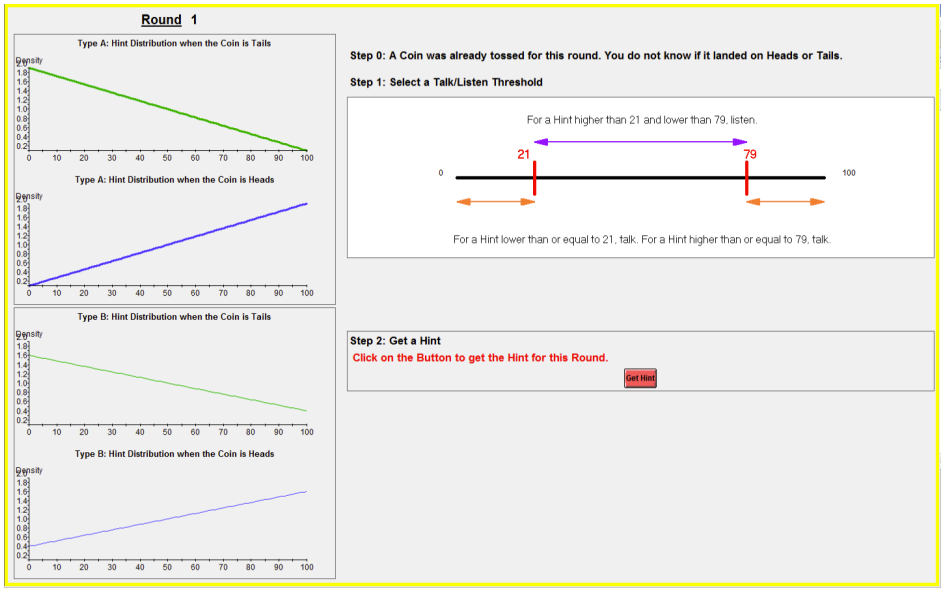


FIGURE A.40

You can change your choice by clicking anywhere else in the line. You can also use the +/- buttons at the bottom. Each time you click on +, you add one unit to the number that corresponds to the lower threshold. Each time you click on – you subtract one unit from the number that corresponds to the lower threshold.

The software imposes that your thresholds are symmetric, so if you get the lower threshold closer to 0 by one unit, the upper threshold will get closer to 100 by one unit as well.

You can now go ahead and change your current choice by clicking elsewhere along the 0-100 line. Please also try using the +/- buttons. Are there any questions?

You can change your choice as long as you don't click on the submit button button, but once you click on the submit button, your choice is final.

Now please click on the submit button." [Figure A.40 shows what participants would see on their screens]

"After you submit your threshold, you move on to Step 2, in which you will receive your Hint for the round. Please click on Get Hint."

[Figure A.41 shows what participants would see on their screens]

"Now you can see your hint and you can decide Talk/Listen just as you did in Part 1. If your choice of Talk/Listen is not consistent with your choice of Step 1 threshold, the interface will inform you that your choice was not consistent and will ask you to modify your choice so that it is consistent with the threshold.

For example, suppose that after you observe the Hint you select to Talk. If for that Hint, your threshold indicates that you would have wanted to Listen, the interface will ask you to modify your choice and to select Listen. Next round when you are selecting a threshold you can modify your choice of threshold if you wanted to.

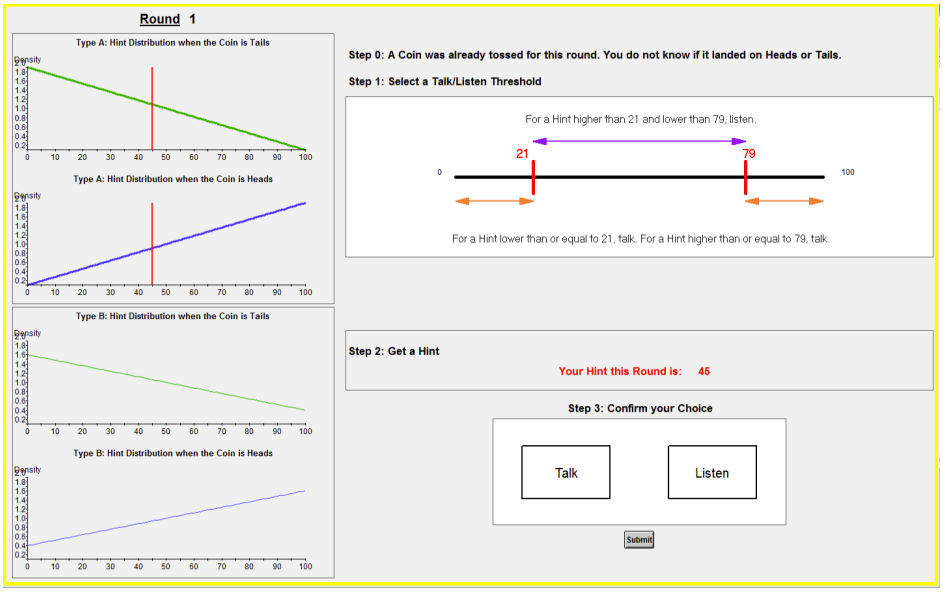


FIGURE A.41

Once your choice Talk/Listen is consistent with your threshold when you press on Submit you will move on to observing whose choice is implemented for the round just as you did in part 1. From now on there are no changes in part 2 and the following steps look exactly as you did in part 1. When you click on the submit button this explanation period will be over."

"We will now start with Part 2. Part 2 consists of 25 rounds. In each round you are randomly matched with another person in the room. Once the 25th round is over, the session will end."

Stage 7: Once the session is over, the software informs subjects on their screen of their earnings. The experimenter pays the subjects their earnings, they sign the receipt and are free to leave the laboratory.

D.3. **Protocol for Conducting a Context-Design Session.** A context-design session consists of 4 stages.

Stage 0: An even number of subjects enters the laboratory. Subjects sign consent forms. Collect consent forms.

Stage 1: Start server and ztree in all computers. Set up ztree in the background. Start Powerpoint in the server. Open file Instructions.ppt. (*One slide, reproduced as Figure A.3*) Read the slide.

Stage 2: Distribute instructions in paper. Read instructions. The instructions are omitted here as they identical as for the symmetric abstract-design session.

Stage 3: Explain to participants how to use the interface. Read the statements between quotes. Do not read statements between brackets.

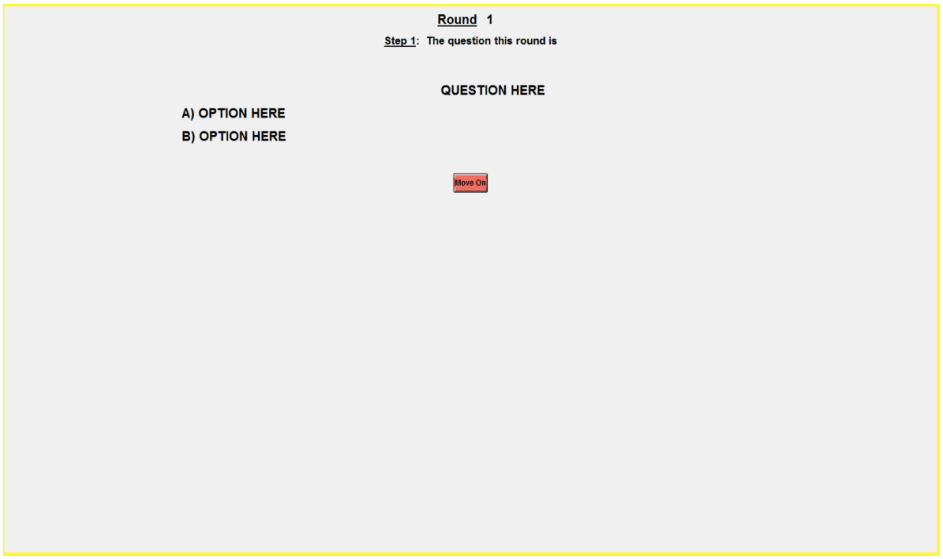


FIGURE A.42

"Now I will start the server. Please do not click anywhere until I ask you to." [start introCont.ztt] [Figure A.42 shows what participants would see on their screens]

"At the top of your screen you can see the Round number. Since this would be the first round, the round number is 1. Immediately below the round number you can see that Step 1 has already taken place. Step 1 presents you with the question for the round. You will see the trivia question for the round, where it says QUESTION HERE. Immediately below you will be able to see the two options, Option A and Option B. After you read the question, click on the Move On button. Is there anybody who hasn't yet clicked on the Move On button?" [If nobody raises their hand, continue reading. Otherwise, ask the person(s) to click on Move On.]

"Now you can see the Step 2 box, where you will write your statement for the round." [Figure A.43 shows what participants would see on their screens]

"Type any message in the light blue area. Click on Enter for it to appear in the grey area. Once the message is in the grey area you cannot change it. You can still write additional lines provided you don't click on a Finish button that will appear. Once you finish with the message, please click on the finish button. A pop-up will appear."

[Figure A.44 shows what participants would see on their screens]

"The pop-up is just to remind you that if you have lines on the blue area that you wish to add to your statement, but have not yet clicked on enter, the lines will not be part of your statement. If you want to modify your message click on NO and complete your statement. If you finished with your statement, click on YES.

Please now type any statement in the light blue area and then click on Enter. Click on the red Finish button that will appear and then click on YES. Recall this is just for practice and will not count for money."

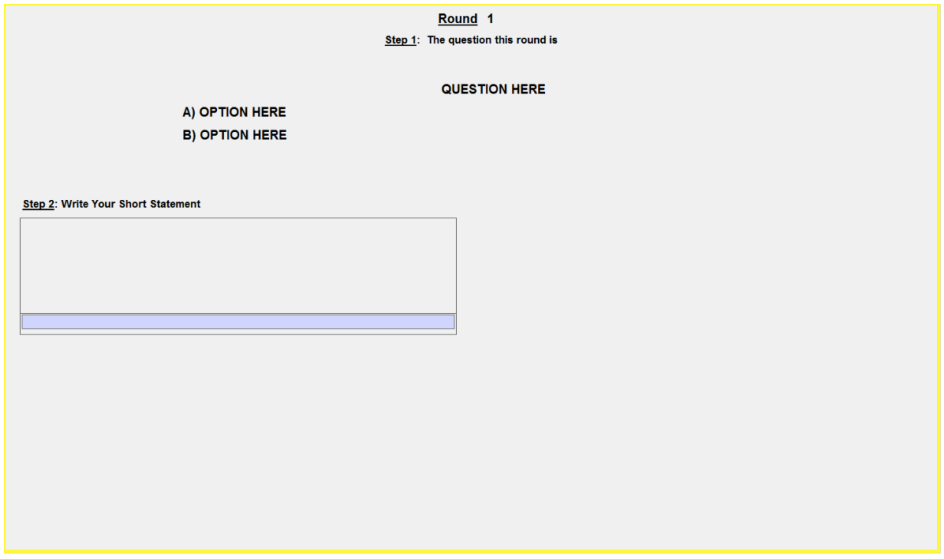


FIGURE A.43

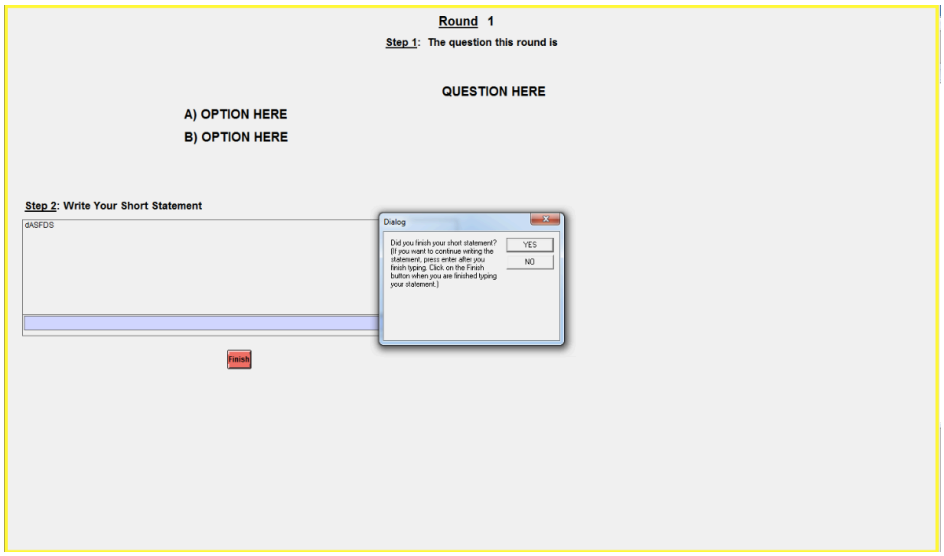


FIGURE A.44

After you finish with your statement, your choice in Step 3 is whether to Talk or Listen. Please do not click anywhere. Recall that if you select Talk and your choice is implemented, the participant you are paired with will see your Hint. If you select Listen and your choice is implemented, you will see the Hint of the participant you're paired with. In order to make a choice, simply click on top of 'Talk' or 'Listen.' Once you click on one alternative, the alternative you select will be highlighted. You can change your choice as long as you don't click on the submit button. Once you click on the submit button your decision is final. Please click on 'Talk' or 'Listen' and then click on the submit button. Recall that your choice does not count for money.

At the top-right of your current screen you can see a summary of steps 1-3. You can see your Hint and your choice. In Step 4, you ask the interface to see the Die roll that decides the choice that is implemented.

Recall that:

- If the die shows a 1 or a 2, then your choice is implemented:
  - You decided to talk: The other participant observes your hint.
  - You decided to listen: You observe the other participant's hint.
- If the die shows a 3 or a 4, then the other participant's choice is implemented:
  - The other participant decided to talk: You observe the other participant's hint.
  - The other participant decided to listen: The other participant observes your statement.
- If the die shows a 5, you will talk for sure: The other participant observes your hint.
- If the die shows a 6, you will listen for sure: You observe the other participant's hint.

Now please click on Get Die. The next screen shows the outcome of the die. In the example, the die resulted in number 5, so you will talk for sure. The participant you are paired with will observe your hint.

If the outcome had been one where you get to read the other's statement, then a box will appear in the Step 4 portion of your screen with the other participant's statement.

Please now click on Move On." [The software for the instruction period is coded so that the die results in #5 to everybody so that nobody gets to observe the hint of the other person. All participants are then in an equal position from the perspective of what they have learnt in the instruction period.]

"In Step 5, your task is to submit a report. You select a number between 0 and 100 that indicates how likely you think that the coin flip was Heads. A report of 0 means that you're sure that the correct answer is B. A report of 100 means that you're sure that the correct answer is A. When you are making choices for money, recall that the payment rule is purposefully designed so that you have the greatest chance of winning $20 when your report is indeed your true assessment on how likely it is that the coin toss was Heads.

Your choice during this period will not count for money. Please enter a number between 0 and 100 and click on submit."

"When you are making choices for money, after you click on the submit button you will receive full feedback. You will be reminded whether you chose to Talk or Listen and your report on the likelihood that the correct answer is A. You will be shown whether the other decided to talk or listen and the other's report. You will also be shown which of the two reports was selected for payment and you will also be told if the correct answer was A

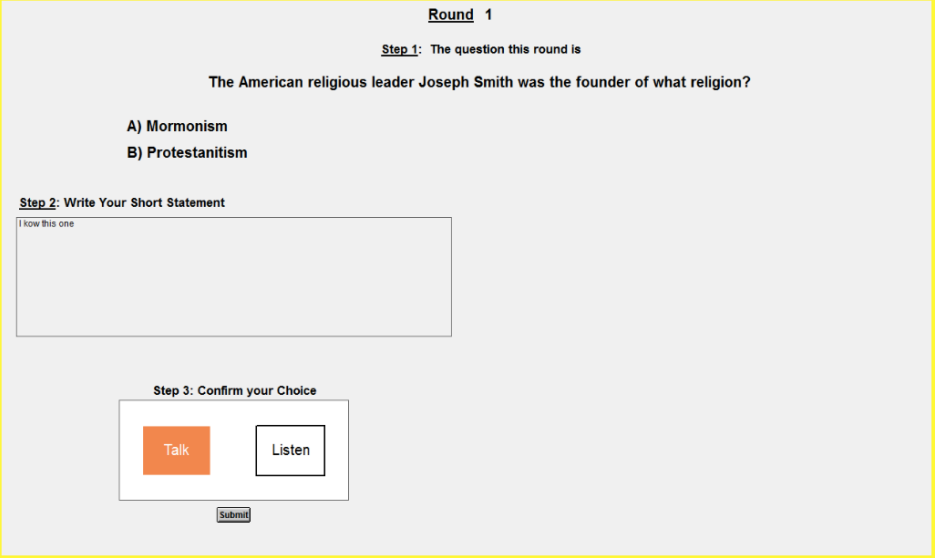


FIGURE A.45

or B for the round. Finally, the feedback screen will also show you the payoff you would receive if the round was selected for payment.

Are there any questions?

You will now start with the session. The session consists of 30 rounds. In each round, you are randomly matched with another person in the room."

[In this instruction stage students do not see any messages from the other or any question or possible answers. So that the reader observes some screenshots for these treatments, here we provide some additional screenshots with one randomly selected question. Figure A.45 shows how subjects make a choice to talk/listen in. Figure A.46 provides an example prior to learning the result from rolling the die. Figure A.47 shows the case where the participant talks so that the participant would not get to observe the other's message. Figure A.48 shows the case where the participant enters the belief. Finally, Figure A.49 shows the case where a subject reads both messages prior to submitting the belief.]

Stage 4: Once the session is over, the software informs subjects on their screen of their earnings. The experimenter pays the subjects their earnings, they sign the receipt and are free to leave the laboratory.

D.4. **Material used in the Context Design .**

D.4.1. *Generating 60 trivia questions* . Two research assistants were provided with the instructions immediately below, and each research assistant produced thirty questions for a total of 60.

In order to generate a question, proceed in the following manner:

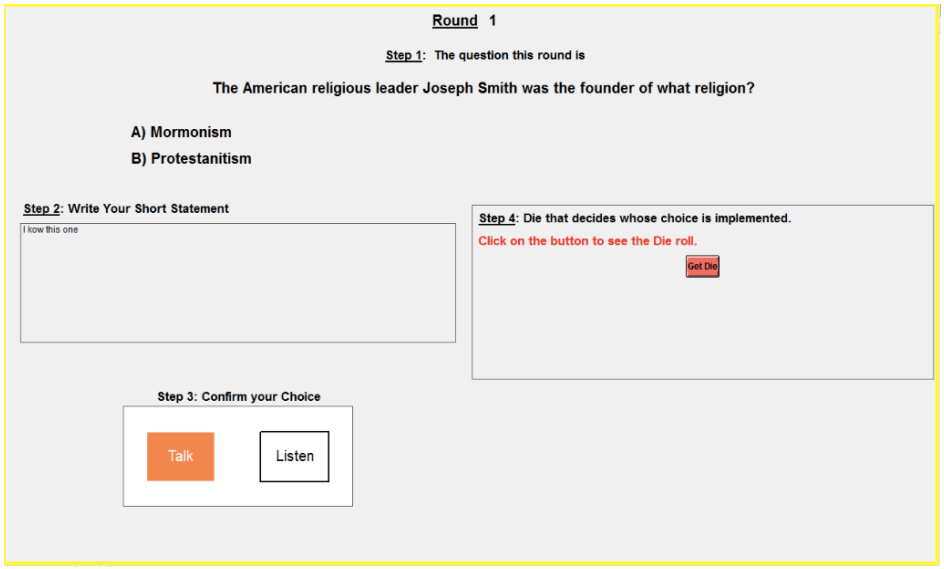


FIGURE A.46

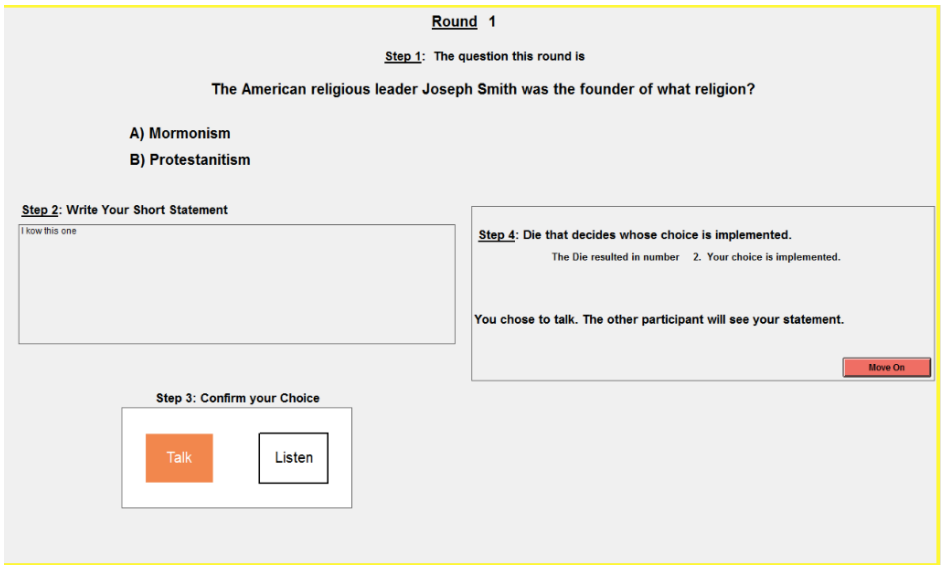


FIGURE A.47

- Go to the following website http://trivia.fyi/categories/ and select a category. Do not select a category more than once.
- The website will generate a random question within each category, but it does not provide possible answers. Generate two possible answers, where one is the correct answer.
- Generate an easy version of the question by providing a hint to the answer in the presentation of the question. Make sure that you do not change the question when adding the hint.

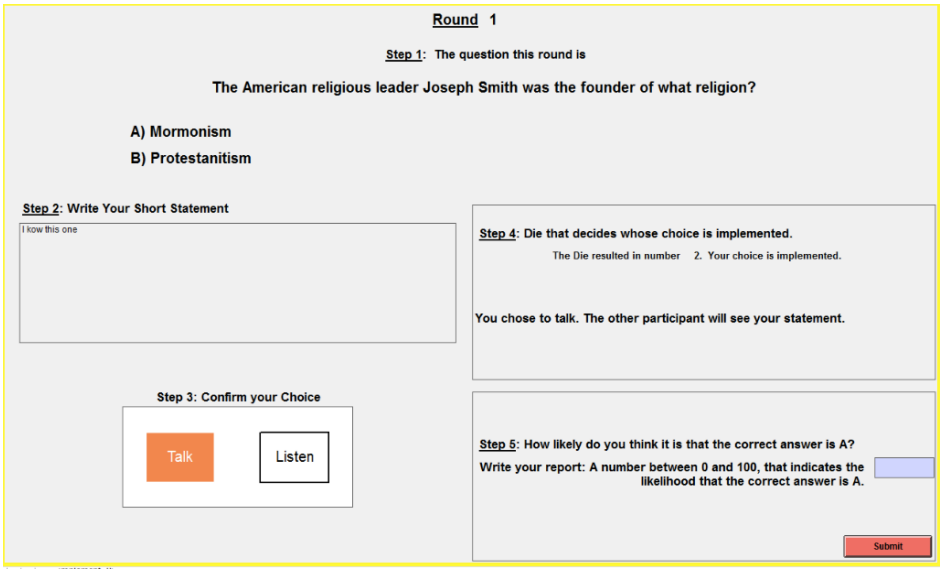


FIGURE A.48

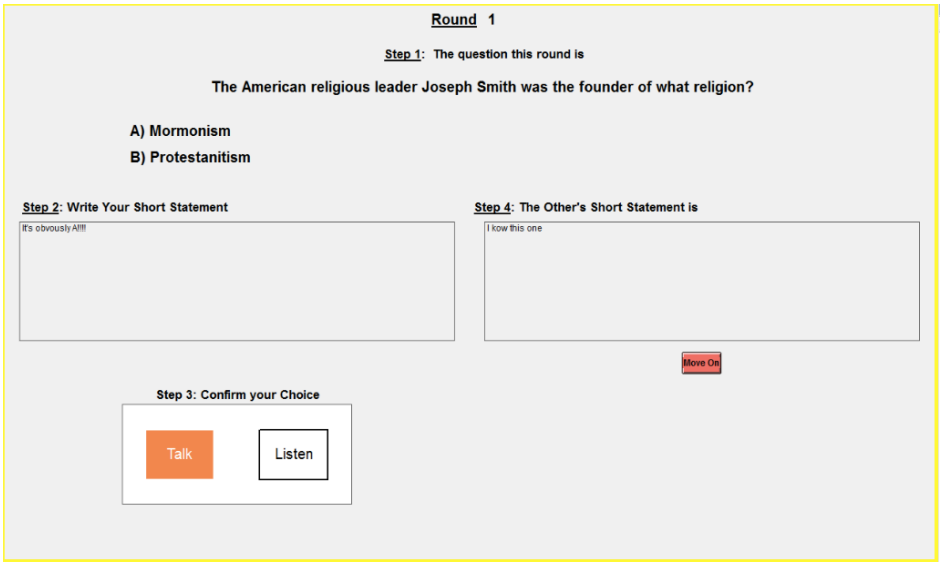


FIGURE A.49

In order to help you with this task, we provide you with a few examples that we have generated.

- Animal trivia.
  - Original question: "What is the name for a mammal that is born incompletely developed and usually carried in the mother's pouch?"
  - Hard version (with possible answers): "What is the name for a mammal that is born incompletely developed and usually carried in the mother's pouch? A: Marsupial B: Mandible"

  - Easy version (with possible answers): "What is the name for a mammal that, like a kangaroo, is born incompletely developed and usually carried in the mother's pouch? A: Marsupial. B: Mandible."

- Australia trivia.
  - Original question: "What is the longest river in Australia?"
  - Hard version (with possible answers): "What is the longest river in Australia? A: Mackenzie River. B: Murray River"
  - Easy version (with possible answers): "What is the longest river in Australia, flowing through several lakes and past large settlings such as Albury, Echuca, Mildura and Murray Bridge? A: Mackenzie River. B: Murray River."

D.4.2. *Selecting 30 out of 60 trivia questions* . We conducted four sessions at UC Santa Barbara, which we refer to as calibration treatments, where all participants faced the 60 trivia questions and had to select between one of the two possible answers. In total 89 subjects participated, 46 faced the hard version and 43 faced what we are going to call the 'initial' easy version. Subjects were told that they would face 60 trivia questions and that at the end of the session one trivia question would be selected for payment. If their answer to the randomly selected question was correct, they would receive $12. If their answer was incorrect, they would receive $3. A session lasted between 20 and 30 minutes. Subjects who participated in these sessions did not participate in any session of our main treatments.

In Section D.4.3 we present the 30 questions that we selected for our Context-Design sessions and in Section D.4.4 we present the 30 questions that were not selected. In each case we describe the hard and the initial easy version for each question, the Correct and Incorrect possible answers and the result in the calibration sessions. Specifically, we report the frequency of correct answers depending on whether subjects faced the hard or initial easy versions.

Prior to collecting the data from the calibration sessions, we planned to keep questions where all the following conditions are satisfied:

(1) the success rate in hard lies inside of the $[0.45, 0.85]$ interval.

(2) the success rate in initial easy lies inside of the $[0.525, 0.925]$ interval.

(3) the success rate in hard is lower than the success rate in initial easy.

Out of the 60 questions, 25 satisfy these criteria. We added 5 more that are relatively close to satisfying these criteria. Eventually, we also prepared a 'final easy version' of each question. Two research assistants that had not been previously involved in generating the questions were provided with the 30 questions that were selected and the hard and initial easy version in each case. They were asked to produce a version of the question that was easier than the initial easy version. Once they provided updates of easy versions to us, we selected the selected the one we thought would be easier among the two alternatives proposed by the research assistants. The 'final easy version' of each question is also presented in each case in Section D.4.3.

D.4.3. *30 Selected Questions* .

- Question 1
  - Question:
    - Hard Version: Which scientist is considered the father of modern genetics?
    - Initial Easy Version: Which scientist is considered the father of modern genetics, who did experiments with pea plants for 8 years from 1856 to 1863?
    - Final Easy Version: Which scientist is considered the father of modern genetics, but did not discover evolution?
  - Answer:
    - Correct: Gregor Mendel
    - Incorrect: Charles Darwin
  - Calibration:
    - Freq. Correct Hard: 54.5%
    - Freq. Correct Initial Easy: 80.5%
- Question 2
  - Question:
    - Hard Version: The Van Gogh museum is located in what European capital city?
    - Initial Easy Version: The Van Gogh museum, in memory of the famous Dutch painter, is located in what European capital city?
    - Final Easy Version: The Van Gogh museum, in memory of the famous Dutch painter, is located in what European capital city known for its canal systems?
  - Answer:
    - Correct: Amsterdam
    - Incorrect: Brussels
  - Calibration:
    - Freq. Correct Hard: 65.9%
    - Freq. Correct Initial Easy: 78.0%
- Question 3
  - Question:

        * Hard Version: In what year was the Chevrolet Chevelle first produced?
        * Initial Easy Version: In what year was the Chevrolet Chevelle, later replaced by the Chevrolet Malibu in the late 1970s, first produced?
        * Final Easy Version: In what year was the Chevrolet Chevelle, later replaced by the Chevrolet Malibu in the mid-1970s, first produced?
    - Answer:
        * Correct: 1964
        * Incorrect: 1974
    - Calibration:
        * Freq. Correct Hard: 84.0%
        * Freq. Correct Initial Easy: 90.2%
- Question 4
    - Question:
        * Hard Version: Which U.S. president signed Father's Day into law?
        * Initial Easy Version: Which U.S. president signed Father's Day into law in 1966?
        * Final Easy Version: Which U.S president both signed Father's Day into law and did not resign from office?
    - Answer:
        * Correct: Lyndon B. Johnson
        * Incorrect: Richard Nixon
    - Calibration:
        * Freq. Correct Hard: 59.1%
        * Freq. Correct Initial Easy: 75.6%
- Question 5
    - Question:
        * Hard Version: Who declined the 1964 Nobel Prize in Literature?
        * Initial Easy Version: Who was the French novelist who declined the 1964 Nobel Prize in Literature?
        * Final Easy Version: Who was the existentialist French novelist who declined the 1964 Nobel Prize in Literature?
    - Answer:

        * Correct: Jean-Paul Sartre
        * Incorrect: Mikhail Sholokhov
    - Calibration:
        * Freq. Correct Hard: 63.6%
        * Freq. Correct Initial Easy: 85.4%
- Question 6
    - Question:
        * Hard Version: What country was the first to send an object to the surface of the moon?
        * Initial Easy Version: What country was the first to send an object to the surface of the moon in 1959?
        * Final Easy Version: What country was the first to send an object, but not a person, to the surface of the moon?
    - Answer:
        * Correct: Soviet Union
        * Incorrect: United States
    - Calibration:
        * Freq. Correct Hard: 72.7%
        * Freq. Correct Initial Easy: 73.2%
- Question 7
    - Question:
        * Hard Version: Who is considered the father of psychoanalysis?
        * Initial Easy Version: Who founded clinical method for treating psychopathology through dialogue between a patient and a psychoanalyst, and is considered the father of psychoanalysis?
        * Final Easy Version: Who is considered the father of psychoanalysis, particularly noted for his introduction of the Oedipus Complex?
    - Answer:
        * Correct: Sigmund Freud
        * Incorrect: Wilhelm Wundt
    - Calibration:
        * Freq. Correct Hard: 81.8%

        * Freq. Correct Initial Easy: 85.4%

- Question 8
    - Question:
        * Hard Version: What mathematician is considered the founder and father of Geometry?
        * Initial Easy Version: What Greek mathematician is considered the founder and father of Geometry?
        * Final Easy Version: What ancient Greek mathematician is considered the founder and father of Geometry?
    - Answer:
        * Correct: Euclid
        * Incorrect: Euler
    - Calibration:
        * Freq. Correct Hard: 47.7%
        * Freq. Correct Initial Easy: 68.3%
- Question 9
    - Question:
        * Hard Version: Dendrophobia is the fear of what?
        * Initial Easy Version: Dendrophobia is the rare fear of what?
        * Final Easy Version: Dendrophobia is the atypical fear of what?
    - Answer:
        * Correct: Trees
        * Incorrect: Spiders
    - Calibration:
        * Freq. Correct Hard: 70.5%
        * Freq. Correct Initial Easy: 90.2%
- Question 10
    - Question:
        * Hard Version: What is the second largest country by landmass?
        * Initial Easy Version: What is the second largest country by landmass and the thirty-eighth by population?

        * Final Easy Version: What northern country is the second largest country by landmass and the thirty-eighth by population?
    - Answer:
        * Correct: Canada
        * Incorrect: The United States
    - Calibration:
        * Freq. Correct Hard: 79.5%
        * Freq. Correct Initial Easy: 82.9%
- Question 11
    - Question:
        * Hard Version: Sri Lanka is surrounded by which ocean?
        * Initial Easy Version: Sri Lanka, which is located in South Asia, is surrounded by which ocean?
        * Final Easy Version: Sri Lanka, an island country located just south of the Indian subcontinent, is surrounded by which ocean?
    - Answer:
        * Correct: Indian Ocean
        * Incorrect: Pacific Ocean
    - Calibration:
        * Freq. Correct Hard: 84.1%
        * Freq. Correct Initial Easy: 87.8%
- Question 12
    - Question:
        * Hard Version: Who developed and patented the electrical telegraph in the United States?
        * Initial Easy Version: Who developed and patented the electrical telegraph in the United States in 1837?
        * Final Easy Version: Who developed and patented the electrical telegraph – along with a code to use it – in the United States in 1837?
    - Answer:
        * Correct: Samuel Morse
        * Incorrect: Nicola Tesla

  - Calibration:
    * Freq. Correct Hard: 59.1%
    * Freq. Correct Initial Easy: 80.5%
- Question 13
  - Question:
    * Hard Version: Joseph Smith was the founder of what religion?
    * Initial Easy Version: The American religious leader Joseph Smith was the founder of what religion?
    * Final Easy Version: The American religious leader Joseph Smith was the founder of what religion headquartered in Utah?
  - Answer:
    * Correct: Mormonism
    * Incorrect: Protestanitism
  - Calibration:
    * Freq. Correct Hard: 72.7%
    * Freq. Correct Initial Easy: 78.0%
- Question 14
  - Question:
    * Hard Version: Which painter started the impressionist movement?
    * Initial Easy Version: Which French painter started the impressionist movement?
    * Final Easy Version: Which French painter started the impressionist movement, which is known for its thin brushstrokes and landscape paintings?
  - Answer:
    * Correct: Claude Monet
    * Incorrect: Salvador Dali
  - Calibration:
    * Freq. Correct Hard: 77.3%
    * Freq. Correct Initial Easy: 78.0%
- Question 15
  - Question:

        * Hard Version: Which US state has the nickname the Treasure State?
        * Initial Easy Version: Which Western US state has the nickname the Treasure State?
        * Final Easy Version: Which Western US state bordering Canada has the nickname the Treasure State?
    - Answer:
        * Correct: Montana
        * Incorrect: Texas
    - Calibration:
        * Freq. Correct Hard: 70.5%
        * Freq. Correct Initial Easy: 85.4%
- Question 16
    - Question:
        * Hard Version: In which country is the Nobel Peace Prize awarded?
        * Initial Easy Version: In which Scandinavian country is the Nobel Peace Prize awarded?
        * Final Easy Version: In which Scandinavian country, neighbor of Finland and Sweden, is the Nobel Peace Prize awarded?
    - Answer:
        * Correct: Norway
        * Incorrect: Belgium
    - Calibration:
        * Freq. Correct Hard: 56.8%
        * Freq. Correct Initial Easy: 75.6%
- Question 17
    - Question:
        * Hard Version: In which US city was Walt Disney born?
        * Initial Easy Version: In which Midwestern US city was Walt Disney born?
        * Final Easy Version: In which Midwestern US city, home to the 2016 World-Series-winning Cubs, was Walt Disney born?
    - Answer:

        * Correct: Chicago
        * Incorrect: Houston
    - Calibration:
        * Freq. Correct Hard: 65.9%
        * Freq. Correct Initial Easy: 78.0%
- Question 18
    - Question:
        * Hard Version: What is the world's smallest country?
        * Initial Easy Version: What is the world's smallest country, which is surrounded by Rome, Italy?
        * Final Easy Version: What is the world's smallest country, surrounded by Rome, Italy and known as the headquarters of the Roman Catholic Church?
    - Answer:
        * Correct: Vatican City
        * Incorrect: Monaco
    - Calibration:
        * Freq. Correct Hard: 79.5%
        * Freq. Correct Initial Easy: 90.2%
- Question 19
    - Question:
        * Hard Version: Olympia is the capital city of which U.S. state?
        * Initial Easy Version: Olympia, which is located about 60 miles away from the Pacific Ocean, is the capital city of which U.S. state?
        * Final Easy Version: Olympia, located on the edge of the west coast, is the capital city of which U.S. state?
    - Answer:
        * Correct: Washington
        * Incorrect: Montana
    - Calibration:
        * Freq. Correct Hard: 68.2%
        * Freq. Correct Initial Easy: 80.5%

- Question 20
  - Question:
    - Hard Version: Bogota is the high-altitude capital of which country?
    - Initial Easy Version: Bogota is the high-altitude capital of which Latin American country?
    - Final Easy Version: Bogota is the high-altitude capital of which Spanish-speaking Latin American country?
  - Answer:
    - Correct: Colombia
    - Incorrect: Gabon
  - Calibration:
    - Freq. Correct Hard: 70.5%
    - Freq. Correct Initial Easy: 87.8%
- Question 21
  - Question:
    - Hard Version: Officially opened in 1869, what artificial waterway connects the Mediterranean Sea to the Red Sea?
    - Initial Easy Version: Officially opened in 1869 in Egypt, what artificial waterway connects the Mediterranean Sea to the Red Sea?
    - Final Easy Version: Officially opened in 1869 in Egypt, what artificial waterway connects the Mediterranean Sea and the Red sea and provides a route between the Atlantic and Indian oceans?
  - Answer:
    - Correct: The Suez Canal
    - Incorrect: The Panama Canal
  - Calibration:
    - Freq. Correct Hard: 68.2%
    - Freq. Correct Initial Easy: 90.2%
- Question 22
  - Question:
    - Hard Version: What is the only U.S. state without a rectangular flag?
    - Initial Easy Version: What U.S. state, which is historically known as the "Buckeye State", is the only state without a rectangular flag?

        * Final Easy Version: What Midwestern U.S. state, which is historically known as the "Buckeye State", is the only state without a rectangular flag?
    - Answer:
        * Correct: Ohio
        * Incorrect: Colorado
    - Calibration:
        * Freq. Correct Hard: 77.3%
        * Freq. Correct Initial Easy: 85.4%
- Question 23
    - Question:
        * Hard Version: Which snake is the world's fastest snake on land?
        * Initial Easy Version: Which snake, whose untreated bite is almost 100 percent fatal, is the world's fastest snake on land?
        * Final Easy Version: Which snake, native to sub-saharan Africa, is the world's fastest snake on land?
    - Answer:
        * Correct: Black Mamba
        * Incorrect: Rattlesnake
    - Calibration:
        * Freq. Correct Hard: 77.3%
        * Freq. Correct Initial Easy: 78.0%
- Question 24
    - Question:
        * Hard Version: The Hoover Dam in the United States is built on what river?
        * Initial Easy Version: The Hoover Dam, which is located on the border between Nevada and Arizona in the United States, is built on what river?
        * Final Easy Version: The Hoover Dam, which is located near the Grand Canyon on the border between Nevada and Arizona in the United States, is built on what river?
    - Answer:
        * Correct: The Colorado River

        * Incorrect: The Mississippi River
    - Calibration:
        * Freq. Correct Hard: 77.3%
        * Freq. Correct Initial Easy: 90.2%
- Question 25
    - Question:
        * Hard Version: What U.S. national park has the nickname 'Crown of the Continent'?
        * Initial Easy Version: What U.S. national park, located in the Northwest corner of Montana, has the nickname 'Crown of the Continent'?
        * Final Easy Version: What U.S. national park, located in the frigid Northwest corner of Montana, has the nickname 'Crown of the Continent'?
    - Answer:
        * Correct: Glacier National Park
        * Incorrect: Yosemite National Park
    - Calibration:
        * Freq. Correct Hard: 54.5%
        * Freq. Correct Initial Easy: 82.3%
- Question 26
    - Question:
        * Hard Version: Who was president of the United States when bombs were dropped in Hiroshima and Nagasaki?
        * Initial Easy Version: Who was president of the United States when bombs were dropped in Hiroshima and Nagasaki? This president took office upon the death of Franklin D. Roosevelt.
        * Final Easy Version: Who was the president of the United States when bombs were dropped in Hiroshima and Nagasaki during the second half of World War Two, assuming the helm after the death of Franklin D. Roosevelt?
    - Answer:
        * Correct: Harry S. Truman
        * Incorrect: Dwight D. Eisenhower
    - Calibration:

        * Freq. Correct Hard: 40.9%
        * Freq. Correct Initial Easy: 85.4%
- Question 27
    - Question:
        * Hard Version: What is the hottest planet in our solar system?
        * Initial Easy Version: What is the hottest planet, which is also the second planet from the Sun and has been made sacred to gods of many cultures, in our solar system?
        * Final Easy Version: What is the hottest planet in our solar system, named after the Roman goddess of beauty and love and sometimes called Earth's sister planet?
    - Answer:
        * Correct: Venus
        * Incorrect: Mercury
    - Calibration:
        * Freq. Correct Hard: 40.9%
        * Freq. Correct Initial Easy: 85.4%
- Question 28
    - Question:
        * Hard Version: The world's fastest growing plant is a species of what?
        * Initial Easy Version: The world's fastest growing plant, growing at up to 35 inches per day, is a species of what?
        * Final Easy Version: The world's fastest growing plant, growing at up to 35 inches per day, is a panda-beloved species of what?
    - Answer:
        * Correct: Bamboo
        * Incorrect: Sunflower
    - Calibration:
        * Freq. Correct Hard: 77.3%
        * Freq. Correct Initial Easy: 92.7%
- Question 29
    - Question:

        * Hard Version: Brazil was once a colony of which European country?
        * Initial Easy Version: Brazil was once a colony of which European country on the Iberian Peninsula?
        * Final Easy Version: Brazil was once a colony of which European country neighbouring Spain?
    - Answer:
        * Correct: Portugal
        * Incorrect: Italy
    - Calibration:
        * Freq. Correct Hard: 86.4%
        * Freq. Correct Initial Easy: 90.2%
- Question 30
    - Question:
        * Hard Version: Penicillin was discovered by which scientist?
        * Initial Easy Version: Penicillin was discovered by which Scottish scientist?
        * Final Easy Version: Penicillin was discovered by which Scottish scientist in the 1900s, who was later knighted for his accomplishment?
    - Answer:
        * Correct: Alexander Fleming
        * Incorrect: Gregor Mendel
    - Calibration:
        * Freq. Correct Hard: 75.0%
        * Freq. Correct Initial Easy: 92.7%

D.4.4. *30 Questions that were Not Selected* .

- Question 31
    - Question:
        * Hard Version: Which is the most abundant metal in the earth's crust?
        * Initial Easy Version: Which is the most abundant metal, also known for its ability to resist corrosion, in the earth's crust?
    - Answer:
        * Correct: Aluminum

        * Incorrect: Iron
    - Calibration:
        * Freq. Correct Hard: 22.7%
        * Freq. Correct Initial Easy: 56.1%
- Question 32
    - Question:
        * Hard Version: American mobster Al Capone was sentenced to 11 years in federal prison for what crime?
        * Easy Version: American mobster Al Capone was sentenced to 11 years in federal prison for what white-collar crime?
    - Answer:
        * Correct: Tax Evasion
        * Incorrect: Drug Trafficking
    - Calibration:
        * Freq. Correct Hard: 81.8%
        * Freq. Correct Initial Easy: 65.9%
- Question 33
    - Question:
        * Hard Version: The ancient Greek statue Aphrodite of Milos, better known as Venus de Milo, is currently on display in what museum?
        * Initial Easy Version: The ancient Greek statue Aphrodite of Milos, better known as Venus de Milo, is currently on display in what art museum?
    - Answer:
        * Correct: Louvre Museum
        * Incorrect: Palace of Versailles
    - Calibration:
        * Freq. Correct Hard: 59.1%
        * Freq. Correct Initial Easy: 51.2%
- Question 34
    - Question:
        * Hard Version: What is the second-most populous city in Australia?

        * Initial Easy Version: What city, also known as the state capital of Victoria, is the second-most populous city in Australia?
    - Answer:
        * Correct:
        * Incorrect:
    - Calibration:
        * Freq. Correct Hard: 75.0%
        * Freq. Correct Initial Easy: 73.2%
- Question 35
    - Question:
        * Hard Version: In what month is the Earth closest to the Sun?
        * Initial Easy Version: In what month is the Earth closest to the Sun, noticing that this distance is not directly related to temperature on Earth?
    - Answer:
        * Correct: January
        * Incorrect: July
    - Calibration:
        * Freq. Correct Hard: 18.2%
        * Freq. Correct Initial Easy: 73.2%
- Question 36
    - Question:
        * Hard Version: Which city has the largest population in the world?
        * Initial Easy Version: Which city, bounded to the east by the East China Sea, has the largest population in the world?
    - Answer:
        * Correct: Shanghai
        * Incorrect: Beijing
    - Calibration:
        * Freq. Correct Hard: 29.5%
        * Freq. Correct Initial Easy: 36.6%
- Question 37

  - Question:
    - Hard Version: What is the most visited museum in Europe?
    - Initial Easy Version: What is the most visited museum in Europe, which holds Leonardo da Vinci's Mona Lisa?
  - Answer:
    - Correct: The Louvre
    - Incorrect: The British Museum
  - Calibration:
    - Freq. Correct Hard: 79.5%
    - Freq. Correct Initial Easy: 95.1%
- Question 38
  - Question:
    - Hard Version: What theory by Albert Einstein earned him the Nobel Prize in 1921?
    - Initial Easy Version: What theory that Albert Einstein published in 1905 earned him the Nobel Prize in 1921?
  - Answer:
    - Correct: Law of photoelectric effect
    - Incorrect: General relativity
  - Calibration:
    - Freq. Correct Hard: 15.9%
    - Freq. Correct Initial Easy: 26.8%
- Question 39
  - Question:
    - Hard Version: The tallest statue in the world as of 2018 is located in what country?
    - Initial Easy Version: The tallest statue in the world as of 2018, the Spring Temple Buddha, is located in what country?
  - Answer:
    - Correct: China
    - Incorrect: India
  - Calibration:

        * Freq. Correct Hard: 43.2%
        * Freq. Correct Initial Easy: 41.5%
- Question 40
    - Question:
        * Hard Version: What is the name of the popular Australian food spread used on sandwiches?
        * Initial Easy Version: What is the name of the popular Australian food spread used on sandwiches, toast and pastries?
    - Answer:
        * Correct: Vegemite
        * Incorrect: Mayonnaise
    - Calibration:
        * Freq. Correct Hard: 81.8%
        * Freq. Correct Initial Easy: 78.0%
- Question 41
    - Question:
        * Hard Version: Copenhagen is the capital city of what country?
        * Initial Easy Version: Originally a Viking fishing village, Copenhagen is the capital city of what country?
    - Answer:
        * Correct: Denmark
        * Incorrect: Belgium
    - Calibration:
        * Freq. Correct Hard: 90.9%
        * Freq. Correct Initial Easy: 92.7%
- Question 42
    - Question:
        * Hard Version: With twelve Oscar nominations, who is the most nominated male actor in Academy Awards history?
        * Initial Easy Version: With twelve Oscar nominations and three wins, who is the most nominated male actor in Academy Awards history?
    - Answer:

        * Correct: Jack Nicholson
        * Incorrect: Al Pacino
    - Calibration:
        * Freq. Correct Hard: 65.9%
        * Freq. Correct Initial Easy: 53.6%
- Question 43
    - Question:
        * Hard Version: Which continent has the highest human population density?
        * Initial Easy Version: Which continent has the highest human population density, with over 4 billion people living there?
    - Answer:
        * Correct: Asia
        * Incorrect: Europe
    - Calibration:
        * Freq. Correct Hard: 88.6%
        * Freq. Correct Initial Easy: 97.6%
- Question 44
    - Question:
        * Hard Version: What is the capital of the country Turkey?
        * Initial Easy Version: What is the capital and second largest city of the country Turkey?
    - Answer:
        * Correct: Ankara
        * Incorrect: Istanbul
    - Calibration:
        * Freq. Correct Hard: 18.2%
        * Freq. Correct Initial Easy: 14.6%
- Question 45
    - Question:
        * Hard Version: Who was the second president of the United States?

        * Initial Easy Version: Who was the second president and the first vice president of the United States?
    - Answer:
        * Correct: John Adams
        * Incorrect: James Madison
    - Calibration:
        * Freq. Correct Hard: 90.9%
        * Freq. Correct Initial Easy: 87.8%
- Question 46
    - Question:
        * Hard Version: In which state was the first oil well drilled in the United States?
        * Initial Easy Version: In which commonwealth state was the first oil well drilled in the United States?
    - Answer:
        * Correct: Pennsylvania
        * Incorrect: Texas
    - Calibration:
        * Freq. Correct Hard: 36.4%
        * Freq. Correct Initial Easy: 56.1%
- Question 47
    - Question:
        * Hard Version: In what country would you find the yellow river?
        * Initial Easy Version: In what Asian country would you find the yellow river?
    - Answer:
        * Correct: China
        * Incorrect: Brazil
    - Calibration:
        * Freq. Correct Hard: 86.4%
        * Freq. Correct Initial Easy: 97.6%
- Question 48

- Question:
    - Hard Version: Sri Lanka is surrounded by which ocean?
    - Initial Easy Version: Sri Lanka, which is located in South Asia, is surrounded by which ocean?
- Answer:
    - Correct: Indian Ocean
    - Incorrect: Pacific Ocean
- Calibration:
    - Freq. Correct Hard: 84.1%
    - Freq. Correct Initial Easy: 87.8%

- Question 49
    - Question:
        - Hard Version: Which country lies on the border between Spain and France?
        - Initial Easy Version: Which landlocked country lies on the border between Spain and France?
    - Answer:
        - Correct: Andorra
        - Incorrect: Monaco
    - Calibration:
        - Freq. Correct Hard: 34.1%
        - Freq. Correct Initial Easy: 48.8%

- Question 50
    - Question:
        - Hard Version: What building is found on the back of a United States 100 dollar bill?
        - Initial Easy Version: What building is found on the back of a United States 100 dollar bill, and is where The Declaration of Independence and U.S. Constitution were both signed?
    - Answer:
        - Correct: Independence Hall
        - Incorrect: The White House

- Calibration:
    - Freq. Correct Hard: 38.6%
    - Freq. Correct Initial Easy: 75.6%

- Question 51
  - Question:
    - Hard Version: Who is the only US president to serve more than two terms?
    - Initial Easy Version: Who is the only US president to serve more than two terms, leading the country through the Great Depression and World War II?
  - Answer:
    - Correct: Franklin D. Roosevelt
    - Incorrect: Ronald Reagan
  - Calibration:
    - Freq. Correct Hard: 86.4%
    - Freq. Correct Initial Easy: 97.6%

- Question 52
  - Question:
    - Hard Version: Who is credited to be the first person to circumnavigate the globe?
    - Initial Easy Version: Who is the Portuguese explorer credited to be the first person to circumnavigate the globe?
  - Answer:
    - Correct: Ferdinand Magellan
    - Incorrect: Marco Polo
  - Calibration:
    - Freq. Correct Hard: 77.3%
    - Freq. Correct Initial Easy: 58.5%

- Question 53
  - Question:
    - Hard Version: Sicily is the largest island in which sea?

        * Initial Easy Version: The Italian island Sicily is the largest island in which sea?
    - Answer:
        * Correct: The Mediterranean Sea
        * Incorrect: The Caribbean Sea
    - Calibration:
        * Freq. Correct Hard: 97.7%
        * Freq. Correct Initial Easy: 92.7%
- Question 54
    - Question:
        * Hard Version: In 1893, which country became the first to give women the right to vote?
        * Initial Easy Version: In 1893, which South Pacific country became the first to give women the right to vote?
    - Answer:
        * Correct: New Zealand
        * Incorrect: Japan
    - Calibration:
        * Freq. Correct Hard: 88.6%
        * Freq. Correct Initial Easy: 95.1%
- Question 55
    - Question:
        * Hard Version: In our solar system, which planet has the shortest day?
        * Initial Easy Version: In our solar system, which planet has the shortest day and is also the largest?
    - Answer:
        * Correct: Jupiter
        * Incorrect: Mars
    - Calibration:
        * Freq. Correct Hard: 36.4%
        * Freq. Correct Initial Easy: 95.2%
- Question 56

  - Question:
    * Hard Version: Which country has the most volcanoes?
    * Initial Easy Version: Which country has the most volcanoes, including the famous Yellowstone supervolcano?
  - Answer:
    * Correct: The United States
    * Incorrect: Japan
  - Calibration:
    * Freq. Correct Hard: 22.7%
    * Freq. Correct Initial Easy: 82.9%
- Question 57
  - Question:
    * Hard Version: In what ocean did the Titanic sink?
    * Initial Easy Version: In what ocean did the British steamship known as the Titanic sink?
  - Answer:
    * Correct: The Atlantic Ocean
    * Incorrect: The Pacific Ocean
  - Calibration:
    * Freq. Correct Hard: 90.9%
    * Freq. Correct Initial Easy: 92.7%
- Question 58
  - Question:
    * Hard Version: Who is the only former heavyweight boxing champ to be buried in Arlington National Cemetery?
    * Initial Easy Version: Who is the only former heavyweight boxing champ to be buried in Arlington National Cemetery, where the dead of the America's conflicts have been buried?
  - Answer:
    * Correct: Joe Louis
    * Incorrect: Muhammad Ali
  - Calibration:

        * Freq. Correct Hard: 25.0%
        * Freq. Correct Initial Easy: 36.6%
- Question 59
    - Question:
        * Hard Version: Which book holds the record of being the most stolen book from public libraries?
        * Initial Easy Version: Which book, originally published in 1955, holds the record of being the most stolen book from public libraries?
    - Answer:
        * Correct: Guinness Book of World Records
        * Incorrect: The Bible
    - Calibration:
        * Freq. Correct Hard: 34.1%
        * Freq. Correct Initial Easy: 73.2%
- Question 60
    - Question:
        * Hard Version: Which U.S. president issued the Emancipation Proclamation?
        * Initial Easy Version: Which U.S. president issued the Emancipation Proclamation in 1863?
    - Answer:
        * Correct: Abraham Lincoln
        * Incorrect: Andrew Johnson
    - Calibration:
        * Freq. Correct Hard: 86.4%
        * Freq. Correct Initial Easy: 95.1%

D.5. **Protocol for Coding Messages in the Context Design .** We provided the protocol to research assistants and in each treatment we had each record coded by two people. That is, we obtained to measures of that is referred to in the protocol below as "Intensity of Message" and "Probability of A." Each participant used the protocol independently and after they provided code answers, research assistants were asked to reconcile any differences. The measures we use in the text are the result of the reconciliation.

The protocol for coding that research assistants received is outlined next.

Use the spreadsheet Messages.xlsx. The first column contains the question number (from 1 to 30). The second column contains the Hard version of the questions. The third columns contains the correct answer. The fourth and fifth columns contain the answer that was presented as A and as B, respectively. The sixth column identifies if the line is the first line that the subject typed or a subsequent line to the first. Each time a person writes a sentence in the chat box a new line in the excel file is created. This means that for the same person there is more than one row in the excel file that corresponds to the same message. The sixth column is entitled same as previous? If the row says New it means that the line has no relationship to the previous line in the excel file. If the row says Same as previous, it means that the line you read in that message is a continuation of the message in the previous row. The seventh column includes the message the subject typed. Here is the information we ask you to include:

- Add a column entitled "Intensity of Message":
  - Type 1 if the person is absolutely sure the answer is A.
  - Type 2 if the person thinks the answer is A but is not sure.
  - Type 3 if the message does not add any information.
  - Type 4 if the person thinks the answer is B but is not sure.
  - Type 5 if the person is absolutely sure the answer is B.
- Add a column entitled "Probability of A": For Intensity of Messages 1, 3 and 5 you don't need to enter anything. We will interpret a 1 as a 100% chance of A, a 3 as 50% chance of A and a 5 as 0% chance of A. Enter a number between 0 and 100 whenever the message can be translated into a number for cases 2 and 4.

Appendix E. Results of the 'Initial Easy' Context Treatment

As we mentioned earlier, our implementation of the initial version of the easy questions was unsuccessful. Here we outline the results of this treatment and compare it to the other context treatments.