Real-effort and Communication

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Abstract

Cheap talk may come in many different forms that are not equally cheap. Different signals may require different costs to the sender but still carry identical information to the receiver. We report the results of an experiment designed to test whether promises which require higher levels of effort result in greater trust from their recipients. We find that more costly promises lead recipients to trust more frequently. However, there is no corresponding, significant difference in the trustworthiness of their senders. Further, when asked their beliefs explicitly, recipients do not believe that higher cost promises are more likely to be trustworthy. This challenges the usual interpretation of the receiver's choice in trust games with communication, wherein their choice is based solely on their own monetary payoff maximization given their beliefs about the sender's likely action. Their trust is, at least partially, other regarding. We conduct a second experiment to further test this result, using a game in which the sender's message cost has no possible influence on their decision. The results of this second experiment are inconclusive.

1 Introduction

Communication encourages cooperation in games well beyond what is expected solely from the players' monetary incentives. The increase in trust and cooperation is particularly pronounced when players communicate through free-form messages, where impact far exceeds prewritten messages with the same literal meaning (Ismayilov and Potters, 2017; Charness and Dufwenberg, 2010). This deviation from standard theory is well established but not completely understood.

Free-form communication introduces numerous possible mechanisms that may increase cooperation. By varying message content, senders may signal traits that correlate with trustworthiness, such as intelligence (Lange et al., 2016; Ruffle and Tobol, 2017). Senders may also select messages to credibly signal their intentions by reducing social distance between sender and receiver (Ismayilov and Potters, 2016), reducing ambiguity (Li et al., 2019), or increasing the magnitude of a potential lie (Geraldes et al., 2021). In this chapter, we explore a new potential explanation of the out-sized effect of free-form communication: effort cost.

Our interest in effort cost is motivated by an observation from Chapter **??**'s trust game with one-way messaging. The game includes the unique design feature that each message is sent to ten different receivers, who each decide whether to trust its sender. Examining the messages trusted by all/none of their recipients shows a stark contrast between the messages in each group. Compared to the least trusted messages, the most trusted messages are longer, more detailed, and contain fewer grammatical or conceptual errors. We interpret the difference between the most and least trusted messages as primarily differences in effort. Table 4 presents the most and least trusted messages.

We examine varying levels of effort cost as a potential signaling mechanism because, in the real-world, cheap talk is not necessarily cheap. Often, senders incur a great deal of cost to send a message which neither credibly signals their type nor changes the payoff structure of the underlying interaction. In everyday economic interactions, people may employ a wide range of channels through which they send cheap talk messages about the quality of their offerings or their promised future actions. A single followup text message or numerous telephone calls from a salesperson to a prospective buyer may both transmit functionally identical relevant information to the buyer but involves a substantial difference in effort. Similarly, a politician running for office may choose between communicating their positions to constituents through bulk mail or through door-to-door visits. In these real-world environments, there are near limitless potential differences between message channels in addition to their effort costs.

In this chapter, we investigate effort as a mechanism for increasing the effectiveness of cheap talk communication. We conduct a trust game experiment with messaging between subjects, replacing free-form communication with the option to send a single, fixed message, promising to cooperate, with the cost of completing a real-effort task. We vary the level of required effort and examine the impact on the Recipients' trust and Senders' trustworthiness. The reminder of this section reviews relevant literature and our hypotheses. Section 2 presents the results of our primary experiment. In section 3, we present the results of a follow-up experiment motivated by the results of Experiment 1. Section 4 summarizes and concludes.

1.1 Background

We study communication in the context of a simplified trust game first used in Berg et al. (1995), depicted in Figure 1. The game involves two players, the Sender and Receiver. The Receiver begins with an endowment of experimental currency, which they may either divide evenly between both players (Out) or pass control to the Sender (In). If the Receiver passes, the total number of tokens increases and the Sender chooses to either divide the tokens evenly (Left) or keep the entire pool, leaving the Receiver with nothing (Right).

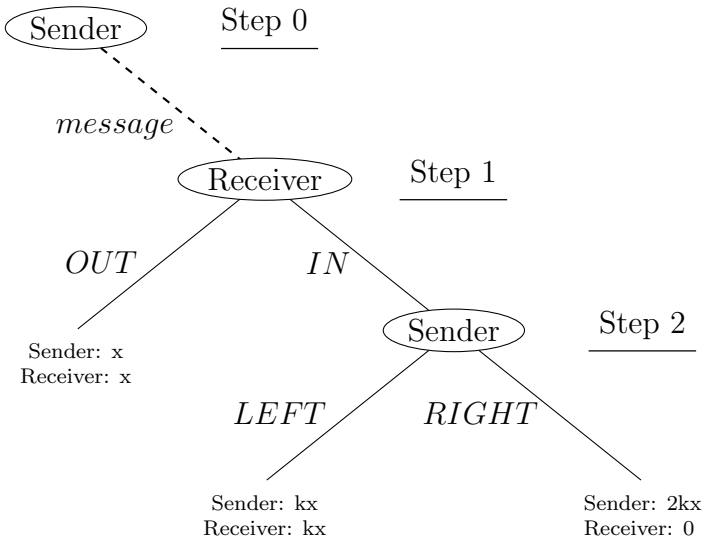


Figure 1: Game tree of a simple trust game.

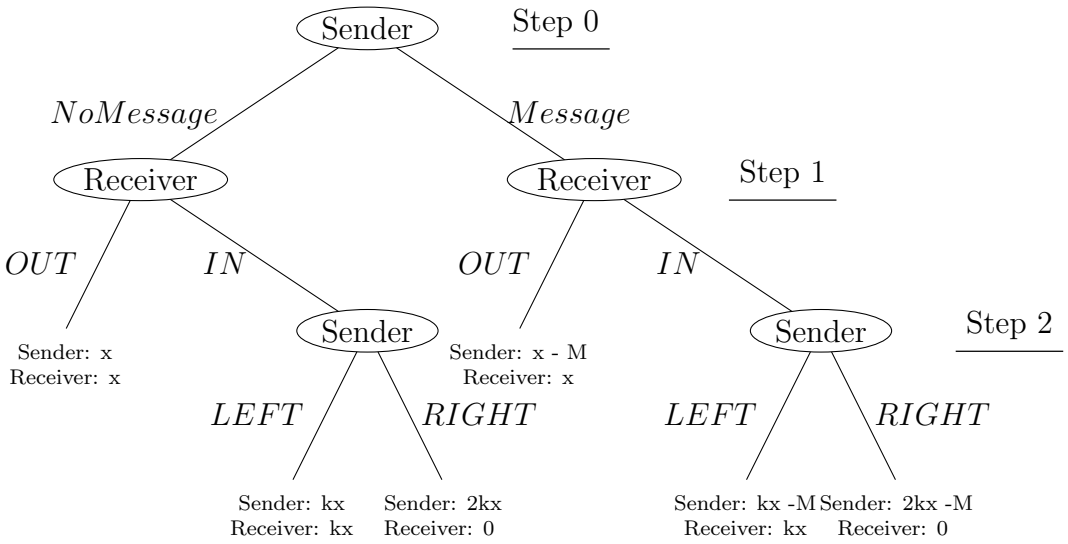
When players are concerned only for their own, material payoffs, the Subgame Prefect Equilibrium (SPE) for this game is trivial. As the sender's payoff for choosing Right is higher, the Receiver knows their payoff will be zero if they choose In and instead choose Out. Potential gains in surplus are undermined by the Sender's individual incentives. The well-established finding in numerous experiments is that both Senders and Receivers routinely deviate from the predicted equilibrium strategies, especially when allowed to communicate (Charness and Dufwenberg, 2006). With selfish preferences, cheap talk communication should not affect the outcome of the game as there is no impact on payoffs from these costless messages.

Augmenting the game tree to include a fixed message costs does not change the SPE prediction as the Sender's choice in step 2 remains Right. As such, the Receiver's equilibrium strategy is to choose Out in both cases. Because of this trivial similarity between the two subgames, the SPE also predicts that the Senders would never choose to incur the communication cost as it only negatively affects their payoffs.

With the trust game described above in mind — where standard, backward induction predicts no potential impact of communication cost — we proceed to review the existing

theoretical models of cheap talk communication and related, costly extensions. These models do little to explain any direct impact of message cost, independent of other considerations.

Figure 2: Simple Trust Game with Message Cost



Augmenting the simple trust game with the introduction of a message cost does not change the SPE prediction.

Formal models of effective cheap talk communication originate with Crawford and Sobel (1982) (CS). The CS model features an uninformed Receiver whose payoffs depend on their action's agreement with the state of the world, and a Sender who is informed about the state of the world but whose payoffs make them upwardly biased. Depending on the degree of alignment between the two players' preferences (i.e. the size of the sender's bias), information exchange is possible even with solely cheap talk messages. Later extensions augment this model to include costs to the sender for misreporting information, whether those be moral aversion to lying, risk of being discovered, etc. (Kartik, 2005; Kartik et al., 2007). Inherently costly communication, regardless of the nature of the message sent, is typically modeled using the size of the message space (Hertel and Smith, 2013), the accuracy of the message (Dewatripont and Tirole, 2005), or the complexity of the message (Sobel, 2012).

In the most closely related to our current environment, costly communication can also take the form of burned money, where senders may choose to incur a cost as a signal in addition to their independent choice of costless, cheap talk messages (Austen-Smith and Banks, 2000). With the presence of costly, burned money signals, more detailed transfer of information may be possible than in pure cheap talk settings, depending on the degree of agreement between the senders' and receivers' preferences, by allowing senders to credibly communicate certain states of the world both parties mutually prefer, provided that the Sender has a sufficiently strong preference towards those states. In experiments that allow for burned money communication, subjects behave largely in accordance with theoretical predictions, using the additional signal available to them to effectively coordinate (De Haan et al., 2015; Krol and Krol, 2020). Although we suppose that Senders of higher-effort mes-

sages are choosing to incur a cost, burned money models are not a plausible mechanism through which this may work. For burned money to explain increased trust from greater effort, Senders would have to value the opportunity to be trustworthy more than their own monetary payoffs.

All of the preceding theoretical models of cheap talk, costly or otherwise, include the key features of an underlying true state of the world and at least a partial alignment of preferences between the sender and receiver. Further, the misalignment of incentives between Sender and Receiver is common knowledge to both players and is explicit in the Sender's payoff functions, making this framework poorly suited for our environment. In a trust game, the state of the world (the Sender's aversion to lying) and thus the misalignment of preferences are both unknown. For effort cost to impact decisions in the above models, one would need to assume that there exists a type of Sender that values the opportunity to be honest more than their own material payoffs.

Existing experiments which add communication costs to otherwise cheap talk messaging focus on the presence of costs to establish a communication system. The communication mechanism is then available to all players, acting as a public good. Higher costs decrease the frequency of messages sent. However, the impact of this decrease in communication varies depending on the details of the structure of the game. In environments where subjects have aligned incentives and are tasked with finding novel or creative solutions to tasks, higher message costs improve the efficiency of game outcomes by filtering out low-quality responses, leaving only well-informed players communicating their information (Charness et al., 2020; Grözinger et al., 2020).

However, in other games, communication costs introduce frictions, which harm subjects' ability to effectively coordinate. Message costs prevent subjects from coordinating on efficient equilibria in stag hunt games (Blume et al., 2017) and in other minimum effort games with a greater number of possible equilibria (Kriss et al., 2016; Fehr, 2017). Subjects in these games exchange fewer messages after the introduction of communication costs and contribute less. The impact of communication costs is highly dependent on the particularities of their context game. Communication costs may also prevent defection in repeated games, with the costs of renegotiating after defection leading to greater compliance between the parties involved (Andersson and Wengström, 2007).

A thorough review of the literature shows that discussions of links between message costs and recipient trust are scarce. The best experimental evidence linking message cost and meaning comes from literature examining costly apologies. Subjects in vignette experiments are more likely to evaluate apologies as genuine when the sender incurs an associated cost, regardless of whether that cost has any benefit to the recipient (Ohtsubo and Watanabe, 2009; Ohtsubo et al., 2012). These findings are supported by further studies using fMRI imaging, although interactions remain unincentivised (Ohtsubo et al., 2018).

In this chapter, we contribute to the literature on free-form, cheap talk communication, examining a new potential source of its disproportionate impact on behavior. Our game structure, with costs independent of the content of a given message, is novel relative to past experimental work, but models commonplace economic interactions. We find that increased message cost leads to increased trust by Recipients. However, the increase in trust is not accompanied by a corresponding increase in the likelihood that Senders will keep their promises. Further, Recipients' stated beliefs suggest that they are aware that the message

cost has no impact on the Senders' behavior.

1.2 Hypothesis

Given that real-world decision makers choose to exert costly effort in excess of what is required to convey the literal meaning of a message, they must expect benefit by altering the actions of the recipient. To change their action in response to a message, a self-interested Receiver must change their beliefs about the Sender. Therefore, the effort cost must change the utility the Sender receives should they break their promise. If the cost of effort is low, relative to the increased potential cost of lying, the Sender may increase their expected utility by incurring the effort cost.

Thus, we propose one of the reasons free-form communication is so effective at increasing cooperation and trust is that Senders can credibly signal their intentions by exerting greater effort. Those who send more costly messages are more likely to keep their promises. Thus, recipients of these promises, being aware of the higher rates of trustworthiness, trust higher-cost messages more frequently. If this proposed mechanism is true, we expect to observe three key pieces of evidence from our experimental data.

- Hypothesis 1: We expect the frequency of trust to be higher with higher message cost, conditional on a promise being sent. We test this against the null hypothesis that the trust rates are the same across all cost levels.
- Hypothesis 2: Because we propose that higher costs strengthen Senders' commitment to their promises, we expect corresponding, higher shares of Senders acting in accordance with their promises when the cost is high. The null hypothesis is that the rates are identical across all costs, conditional on promises.
- Hypothesis 3: We expect the perceived cost of effort by the Senders to be low relative to the material payoffs of the game.
- Hypothesis 4: Finally, if greater trust is driven by stronger commitment by the Senders, the Receivers must believe this to be the case. We expect the stated beliefs of Receivers regarding the likelihood Senders will share the tokens to increase along with message cost. Receivers believe that Senders of high-cost promises are more likely to share the tokens than others. We test this against the null that the beliefs stated by Receivers about the Sender's actions are equal across all cost levels.

2 Experiment 1

2.1 Experiment 1: Methods

We conduct a trust game with one-way communication on Amazon Mechanical Turk (MTurk). The game proceeds in two steps between two players the Sender and the Receiver. In step 1, the Receiver begins with an initial endowment of 16 tokens which they may either split evenly between both players, ending the game, or pass to the Sender. If they pass the tokens,

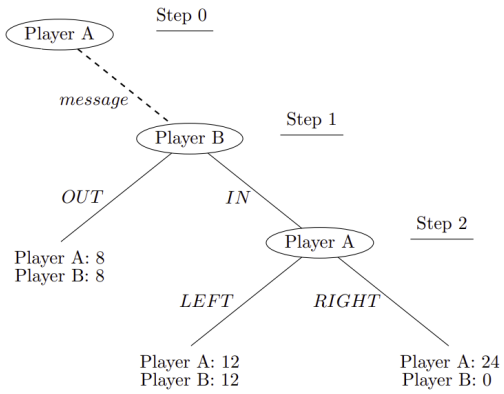


Figure 3: Trust game with payoffs used in experiment 1

the total sum of tokens increases to 24 tokens and the Sender may either split the tokens evenly between the two or keep them all.

To examine the effect of varying levels of effort, we implement a modified communication mechanism that allows the effort required to compose a message to vary without altering its literal meaning. Instead of free-form text, Senders may send a single, prewritten message, "I will choose Left," or no message at all. If they choose to send the message, senders incur a real-effort cost which varies across treatments; declining to send a message is costless, bypassing the real-effort task altogether. Participants are aware of this cost prior to making the choice to send a message.

We impose this real-effort cost by requiring that Senders complete a series of slider tasks to send a message. Subjects must adjust a series of slider bars to match a randomly chosen target value ranging from 0 to 100. The cost of sending this message varies between our five treatments: 0, 1, 3, 8, or 20 correctly positioned sliders. We employ a between subject design with each participant encountering only one effort level treatment. Correctly positioning 20 sliders requires roughly 1 minute of real-effort for the average participant to complete. With an average total participation time of 8 minutes, this represents a substantial portion of the total effort put forth in their participation. All subjects must complete example slider tasks as part of their comprehension check, ensuring that they are familiar with the effort involved. By implementing this communication mechanism, we hold the information content constant, while varying the cost to the Sender. An image of the message interface is included in the Appendix, Figure **??**.

Each subject proceeds through the experiment in the same order. After reading the game instructions and successfully completing the comprehension check, each subject acts first as the Sender, making their message choice followed by their action choice, and then as the Receiver, choosing between In and Out. Each subject plays the game once as the Sender and five times as the Receiver. Subjects are paired in the order of their arrival, acting as Receiver for the five people who arrived immediately before and as Sender for the five arriving immediately after. We run this game on Amazon Mechanical Turk (MTurk)

using a game built on the oTree framework (Chen et al., 2016). We restrict eligibility to include workers who have completed 1000 previous tasks with an approval rate of at least 99%, corresponding to roughly the top 75th percentile of MTurk workers (**?**).

2.2 Experiment 1: Results

Our data consist of responses from 204 participants. The mean participation time and earnings were 8 minutes and $2.10 respectively. Figures 4 and 5 present the primary results across the five treatment groups.

Across all five treatments, the prewritten promises increase cooperation between players. Receivers who receive the message promising to choose Left are significantly more likely to choose In compared to those whose partners decline to send the message, regardless of the real-effort cost. Likewise, Senders who send the message are also significantly more likely to choose Left across all treatments, supporting the Receivers' decision to entrust them with the tokens.

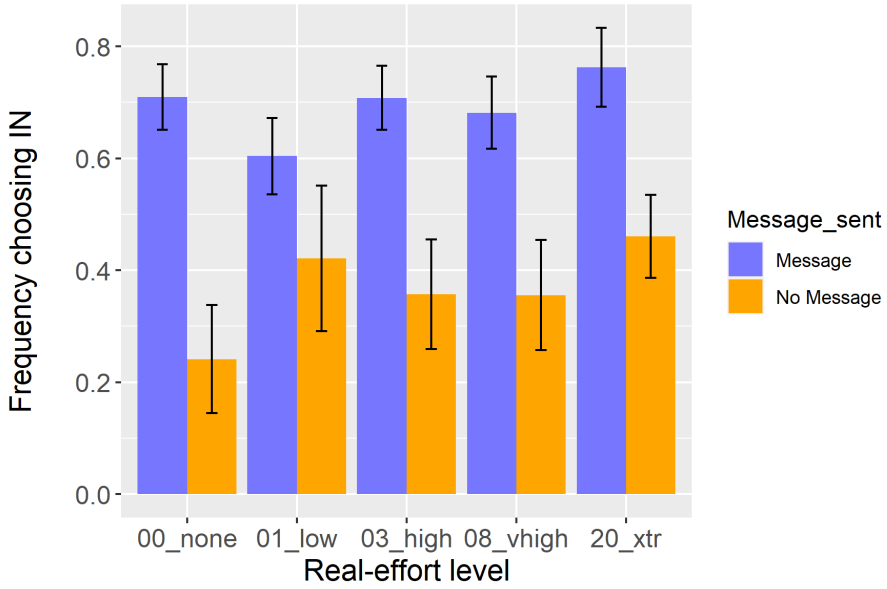
Our primary hypothesis is that greater real-effort cost to send a message will increase both trust (the likelihood a Receiver chooses In) and trustworthiness (the likelihood a Sender chooses Left). Senders bear an increased cost of violating a carefully crafted promise making it a more reliable commitment mechanism, which recipients correctly interpret. Our subjects' choices when acting as Receiver follow the expected pattern when there is real-effort cost required. Compared to the Low treatment (1 slider task), recipients of promises requiring High (3) and Extreme (20) levels of effort to send are significantly more likely to choose Left (p-values .011 and .001 respectively.) Furthermore, promises that required 20 slider tasks are trusted at the highest rate of all, with a significant difference between the Low and Very High treatments at the 5% level (p-values .001 and .049). Full tables p-values for pairwise comparisons are included in Appendix **??**.

Table 1 presents the results of OLS regressions regressing the frequency choosing In on the number of sliders required. When a message is sent and None treatments are excluded, we find a positive, statistically significant correlation between effort and trust. Estimates including None treatments are positive, but fail to meet the threshold of significant at the 5% level.

When Senders decline to send a message, there is no clear relationship between effort cost and trust. We find no statistically significant difference between the rate of trust receivers place in senders declining to send a message between the Low, High, and Very High effort levels. In extreme effort treatment, Receivers are significantly more likely to choose Left after receiving no message compared to None treatments (p-value = .001). However, there is no significant difference between the Extreme and the Low treatment. As shown in Table 1, we find no statistically significant correlation between the number of sliders required and the frequency of Receivers choosing In when no message is sent.

Having seen that Recipients' trust increases as the effort to send a promise to play Left increases, we now move to the Senders' choices between Right and Left. For our proposed mechanism to hold, the increase in trust from Receivers must be supported by a corresponding increase in trustworthiness from the Senders. In three of the five treatments, Senders who choose to send the promise are significantly more likely to choose Left than those who do not. However, conditional on the message, or lack thereof, we do not find statistically significant

Figure 4: Receiver Choices by Required Effort Level



differences in the Sender's Left/Right between any of the five effort level treatments.

As effort cost increases, trust increases without evidence of a corresponding increase in Senders' trustworthiness. In our proposed mechanism, we expect that increased trust is driven by the accurate belief that higher effort message will be more trustworthy as it is more costly to violate. We now examine subjects' stated beliefs about Senders' actions, given that a message was sent. If their beliefs about the likelihood that a message sender will choose Left increases along with trust, they believe that the message cost reinforces commitment but are mistaken. Figure 6 presents subjects' beliefs by effort level.

We find no evidence of significant differences in subjects' beliefs between any of our five treatments. Beliefs agree with our results regarding the Senders' choices. Subjects do not believe that higher effort promises lead to a higher frequency of their Senders choosing Left.

Finally, at the end of the experiment, we ask the subjects their hypothetical willingness to pay for the opportunity to send a message without completing the slider task. Across all treatments, the median response was zero tokens, indicating a complete unwillingness to incur monetary losses to reduce real-effort expenditure. This supports Hypothesis 3 that the cost of effort is small relative to the material payoffs.

2.3 Experiment 1: Discussion

At first glance, Experiment 1 yields puzzling results which suggest a contradiction between Receivers' beliefs and actions. Consistent with our proposed mechanism, a higher level of effort required to send a promise is indeed associated with a higher likelihood that its recipient will choose In, passing the tokens to their partner. However, this change in action is not supported by a corresponding change in beliefs. When asked directly to provide their estimate of the likelihood that a message's sender will choose Left, subjects' mean responses do not change between levels of effort. What makes this apparent misalignment between

Figure 5: Sender Actions by Required Effort Level

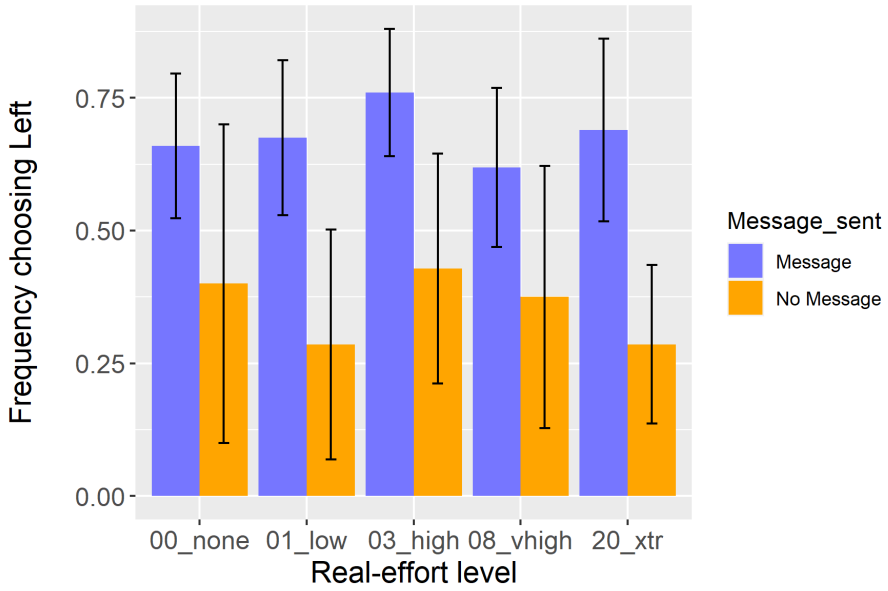
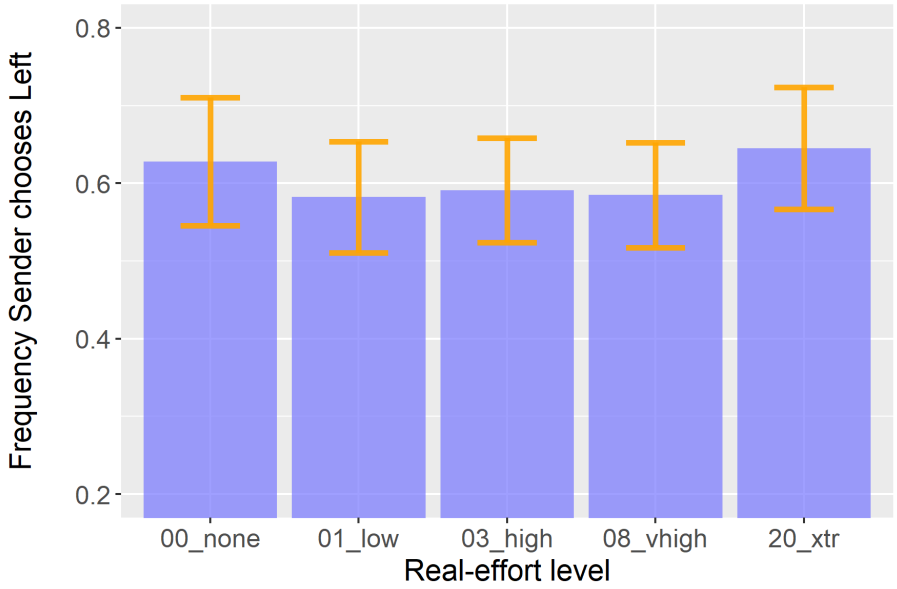


Table 1: Regression Estimates: Choices on Effort

	Trust		**Share**	
	Message (p-value)	No Message (p-value)	Message (p-value)	No Message (p-value)
Including No effort	0.0043‘ (0.057)	0.0063 (0.107)	-.0001 (0.891)	-.0043 (0.642)
Excluding No effort	0.0061* (0.014)	0.0043 (0.326)	-.0019 (0.732)	-.0039 (0.703)
Observations	1010/779	230/200	208/160	40/35

OLS coefficient estimates when regressing trust frequency (Receivers choosing Left) and Share frequency (Senders choosing Left) on the number of sliders required.
‘ : $p < .1, * : p < .05, ** : p < .01$

Figure 6: First Order Receiver Beliefs Following a Promise



Subjects' average estimates of the frequency choosing Left under each treatment. 95% confidence intervals are plotted in black

stated beliefs and actions more notable is that these beliefs are correct. Examining subjects' choices in the Sender role, we see no significant differences in Left/Right choices between any of our treatments.

These patterns of behavior – increasing trust despite Receivers' beliefs and Senders' actions remaining unchanged – implies that our proposed mechanism through which free-form communication has such an exceptional impact is incorrect. The amount of effort required to send a promise does not change the reliability of its content. However, the recipients of these messages do change their behavior as effort cost increases. Furthermore, Receivers increase their trust in their partners in spite of their stated beliefs. Receivers know that Senders of more costly messages are no more likely to choose Left if given the opportunity.

This mismatch between the Receivers' actions and the payoff maximizing response implied by their beliefs raises important questions about our interpretation of the trust game. Although we have, up to this point, treated a Receiver's choice to play In as synonymous with trust, subjects' beliefs raise doubts about the propriety of this interpretation. Although the consequence of this action is to entrust the outcome of the game to one's partner, our evidence suggests that this is not entirely driven by the belief that their partners will keep their promise. The recipients of higher-effort promises appear to be motivated to choose Left in response for reasons other than beliefs about the Sender's action.

If Receivers truly choose In at higher rates without believing that there is a corresponding increase in trustworthiness, then there is a significant gap in the current understanding of communication in trust games. Current models assume that Receivers trust promises

(choose In) because the choice maximizes their expected monetary payoffs based on their first order beliefs about Senders' choices given that they sent a promise. Promises increase the likelihood of trustworthiness on the part of the Sender either through guilt aversion based on the Sender's second order beliefs (Charness and Dufwenberg, 2006; Khalmetski, 2016; Ederer and Stremitzer, 2017; Di Bartolomeo et al., 2023) or through the Sender's aversion to the inherent inconsistency involved in telling a lie (Vanberg, 2008) — Expectation based and Commitment based explanations. Our results appear to show that other factors influence Receivers' In choices. Receivers stated first order beliefs about Sender's In/Out decisions show no change as effort changes yet Receivers choices do change. Factors other than expected payoff influence Receivers' choices.

To investigate this further, we conduct a second experiment to focus on these other factors, removing the possibility that recipients can infer any information relevant to their monetary payoff from the communication mechanism by introducing a chance that the Sender's decision is out of their control. In doing so, we can isolate any effect caused by the changing levels of effort required of message Senders independent of any possible signal about the Sender's Left/Right choice. When the Sender's decision is made by a random device, Receivers' expected payoffs are fixed and known. Any changes in Receivers' behavior as effort changes cannot be explained using existing models of trust.

3 Experiment 2

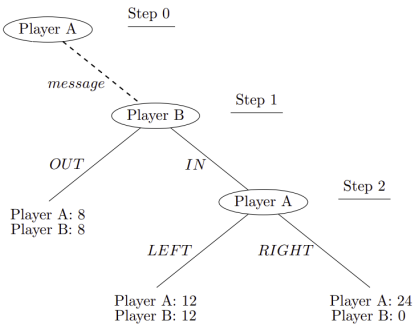
3.1 Experiment 2: Methods

In light of the results of Experiment 1, we conduct a second experiment to further explore the apparent contradiction between Receiver's trust and Senders' trustworthiness as effort cost increases. To do this, we conduct a modified version of the previous trust game with communication, introducing conditions where a Sender's action choice is taken out of their control after they have sent their message.

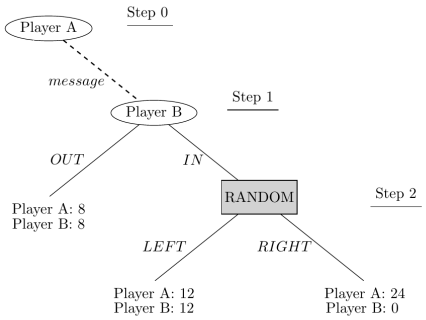
As before, we recruit subjects from MTurk participate in a trust game with restricted communication. After completing a comprehension check, participants proceed through the game acting first the Sender and then as the Receiver. In the sender role, the task remains unchanged from Experiment 1. Senders first choose whether or not to send a single fixed message,"I will choose Left". If they choose to send the message, they incur real-effort cost which varies across two treatments. The treatments; Low and High effort require 1 and 8 slider tasks, respectively.

After the sender has made their message and action choices, they then play five rounds of the game as the Receiver. As before, the Receiver will receive the message or lack thereof, knowing the effort cost required to send it. However, we introduce the chance that the Sender's action choice is disregarded and determined randomly, with no influence from the Sender. If the Left/Right choice is random, Receivers are informed clearly that the Sender has no bearing on the outcome prior to making their decision between In and Out.

This mechanism is similar to one used in Ederer and Stremitzer (2017) to exogenously vary Receivers' expectations by introducing an unreliable mechanism which alters the level of control the Sender has over their own choice. We use this mechanism to compare varying



(a) Without random Sender choice



(b) With random Sender choice

Figure 7: Game trees with and without random choice as seen by Receivers

levels of effort when expectations are constant and unambiguous. When nature chooses a random mechanism after the message but before the Receiver's choice, any changes variation in trust rates cannot be attributed to either commitment based or expectations based explanations.

3.2 Experiment 2: Hypotheses

The typical interpretation of a Receiver's In choice is that they trust the Sender to share the tokens. The Receiver's trust is based on maximizing their own expected payoff given their beliefs about the Sender. If this interpretation is a full account of the Receivers' considerations, effort cost cannot plausibly affect the Receiver's choice when the Sender does not control the choice between Left and Right.

In the cases where the In/Out decision is made by chance rather than by the Sender, there is no possibility that the Receiver may infer any information about their expected payoff from a message. Thus, changing the effort required to send the message should also have no impact on its recipient's behavior.

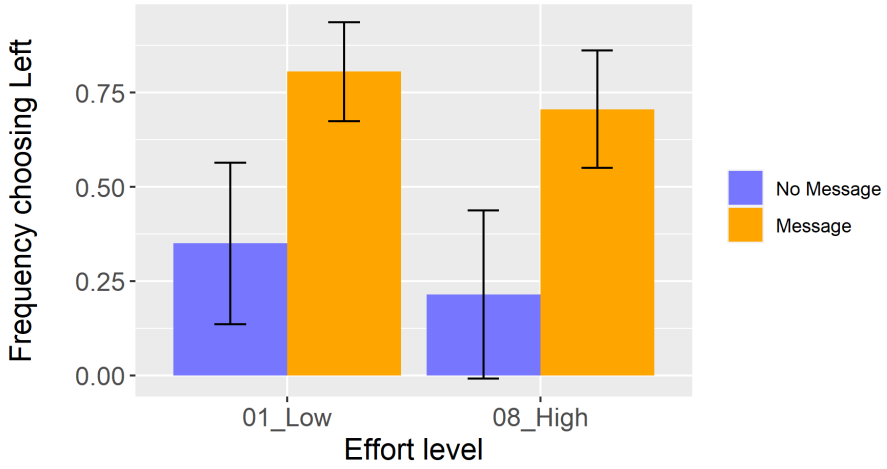
However, the results from Experiment 1 suggest that the different levels of effort do not change the Receivers' estimations of the likelihood the Sender will share the tokens. If there truly is no change in beliefs, it implies that Receivers view their choice to pass the tokens as a fixed lottery, regardless of the effort cost. As such, we expect the pattern of increased trust with effort to remain even when the Sender's intentions are irrelevant.

We test this against the null that the mean likelihood that a recipient will choose In is equal across all treatments when the In/Out choice is removed from the Sender.

3.3 Experiment 2: Results

Experiment 2 was conducted on MTurk during the Spring of 2024. Our data consist of choices made by 103 participants. Average participation time was less than 10 minutes and typical earnings were $2.00. The procedures and hypotheses for Experiment 2 were preregistered with the Open Science Foundation (https://osf.io/vt63c)

Figure 8: Sender Choices by Required Effort



95% confidence intervals are plotted in black

Figure 8 presents data relevant to Senders' choices. Consistent with previous literature and our own results in Experiment 1, Senders who choose to send the promise are more likely to choose Left than those who send no message across both effort levels. Again, as in experiment 1, we find no statistically significant difference in Senders' Left/Right choices between treatments; effort is not associated with greater trustworthiness.

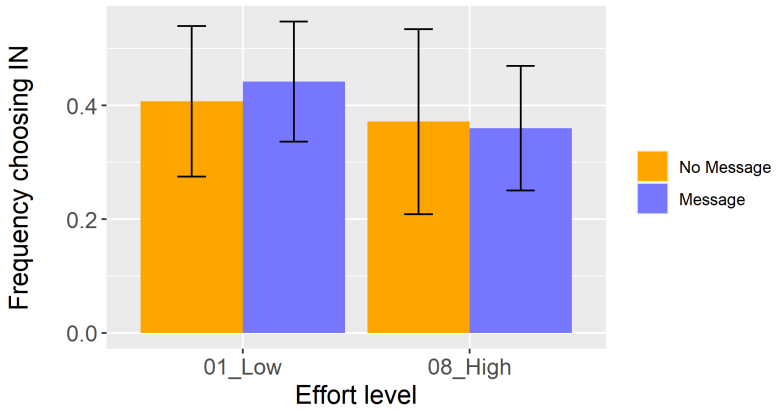
The design of Experiment 2 assumes that subjects' decisions will be unaffected unless the Senders' choices are replaced with a random mechanism. As the Sender's decisions all occur prior to the random mechanism, we expect them to be similar to Experiment 1. The results for Senders' choices are consistent with this assumption.

We then test our primary hypothesis for Experiment 2: Receivers will choose In at higher rates for higher effort promises, regardless of whether their partner's decision is made randomly or by a human. If Receivers have other regarding preferences towards Senders, Receivers should choose In more frequently in response to high effort promises when the Left/Right choice is made randomly. Figure 9 presents Receiver choices when they are informed the Sender's choice will be random.

The choices made by Receivers in our experiment do not support our hypothesis. We find no statistically significant difference between the frequency of Receivers choosing In after receiving the promise between treatments. Further, we do not find a statistically significant difference in the frequency choosing In between between treatments when no message is sent or between message/no message cases within the same treatment.

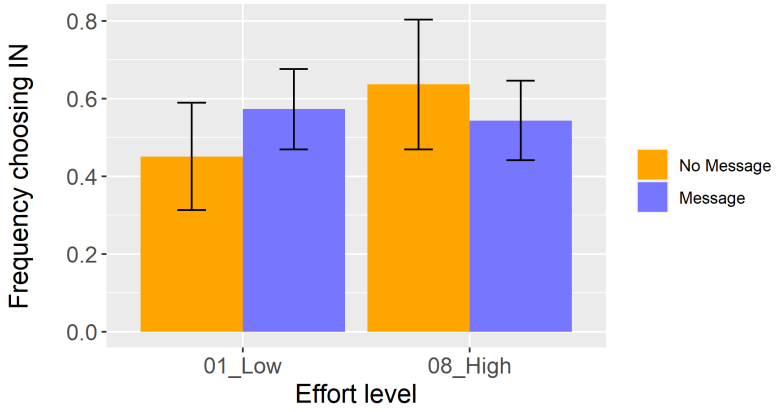
Our design for Experiment 2 assumes that when the Sender's choice is made by a human, Receivers' decisions should follow the patterns observed in Experiment 1: higher In frequencies in response to promises and higher In frequencies following promises in higher effort treatments. Receivers know when making their In/Out decision that their human partner will make the Left/Right decision. The information and structure of the game are identical

Figure 9: Receiver Responses when Sender Choices are Random



95% confidence intervals are plotted in black

Figure 10: Receiver Response when Senders Retain Control

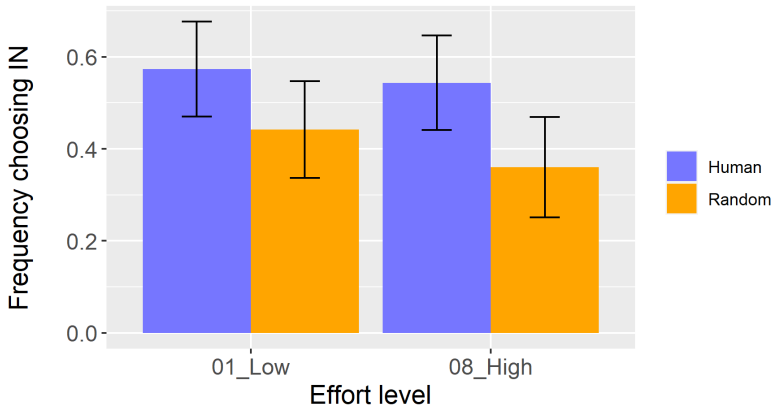


95% confidence intervals are plotted in black

to Experiment 1. Figure 10 presents Receivers' choices when their human partner makes the Left/Right decision.

Unlike in Experiment 1, we do not observe that promises increase the frequency of Receivers choosing In. There is no statistically significant difference between message/no message cases in either treatment. Further, we do not observe an increase in the frequency choosing In as effort cost increases. These two results are not consistent with our findings in Experiment 1 although the game structure and available information are the same for the Receivers making these choices.

Figure 11: Receiver Choices Following a Message



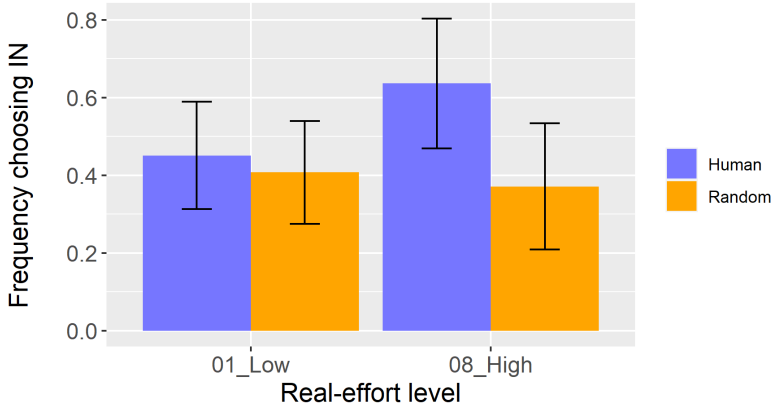
95% confidence intervals are plotted in black

Figures 11 and 12 present data comparing Receivers' responses to messages (or lack thereof) when the Left/Right decision is made by a human versus when it is made randomly.

Receivers of promises in Experiment 2 choose In less often when the Left/Right decision is random instead of human controlled. However, this difference is not statistically significant in either the high or low effort treatments.

The same is true for Receivers who receive no message (Figure 12). The proportion of Receivers choosing In is lower in random choice cases versus human choice cases, but this difference is not statistically significant.

Figure 12: Receiver Choices Following No Message



95% confidence intervals are plotted in black

3.4 Experiment 2: Discussion

The results of Experiment 2 do not support the hypothesis developed in response to Experiment 1. In Experiment 1, 'trust' rates in response to promises increase as the effort required

to send the promise increases. There was no corresponding statistically significant increase in Senders' trustworthiness nor was there an increase in the Receivers' first order beliefs regarding Senders' actions. We designed Experiment 2 to test whether we can observe an increase in 'trust' in an environment where the Senders' actions and the Receivers' first-order beliefs cannot possibly be related to the Senders' message choice or effort level. We create this environment by introducing the possibility that a Sender's choice will be replaced with a coin-flip after they have made their message choice and exerted the necessary effort but before the Recipient chooses In or Out.

Our data in Experiment 2 do not support our hypothesis. When the In/Out choice is made randomly, Receivers are not significantly more likely to choose In in response to a promise when the effort cost is higher. Our hypothesis predicts that Receivers will more often 'trust' Senders who incurred a greater cost to send their promise independent of any information they may infer about the Sender's reliability.

However, other results from Experiment 2 indicate that there may be a flaw in the design of our decision task. In cases when the Left/Right choice is not random — the game proceeding, in theory, identically to the game in Experiment 1 — we do not replicate the results of Experiment 1. Senders who send promises are still more trustworthy than those who do not send a message. However, Receivers do not respond accordingly. When the Left/Right choice is made by their human partner, Receivers are not significantly more likely to choose In following a promise versus no message. This failure to replicate the promise effect, present in both Experiment 1 and numerous prior studies, raises doubts about the validity of our results. Introducing the potential random Left/Right choice may have made the task more difficult for subjects to comprehend in their brief participation time or introduced ambiguity about when the random mechanism is determined or to whom payoff is assigned. Experiment 2 does not support the hypothesis developed following Experiment 1, but it is uncertain whether this a true reflection of participants' decision making or the result of our game's design.

4 Conclusion

In this chapter, we present the results of two experiments designed to investigate why free-form communication has an outsized effect on cooperation in economic decision making. We isolate one factor out of the limitless possible signals contained in free-form messages — real-effort cost — and implement a communication mechanism in a trust game which allows us to vary the level of effort required to send a message while leaving the message content unchanged. Senders may send a fixed message promising to share the payoff equally or send no message at all. Sending the message requires the Sender to exert real-effort in the form of a slider task which we vary across treatments.

We find that Receivers trust higher effort promises significantly more often than lower-effort promises. Across all effort levels, Receivers trust promises more than the absence of a message, consistent with existing literature. This increase in trust with effort is not complemented by a statistically significant increase in their Senders' trustworthiness. One is tempted to attribute this increase in trust without increasing trustworthiness to an error in the Receivers' judgement, inferring greater trustworthiness falsely from higher effort cost.

However, the stated first order beliefs of the Receivers do not support this. When asked to estimate the frequency senders of promises choose Left for varying levels of effort, there is no statistically significant difference between treatments.

In total, these three findings (effort increasing trust but not trustworthiness or beliefs about trustworthiness) suggest that Receivers' In/Out decisions are influenced by more than their own payoff maximization. If higher effort cost truly does not change Receivers' beliefs but it increases the frequency with which they play In, then Receivers' choice to play In cannot solely be called 'trust.' The evidence available to us suggests that the choice to 'trust' may partially be motivated by the Receivers' consideration of the Senders' expectations.

At present, the evidence for this result is somewhat weak and based on interpreting the lack of a significant differences in beliefs as evidence that they are unchanging. To address this weakness, we conduct a second experiment, modifying the procedures in Experiment 1 so that Receivers' beliefs about Senders' actions cannot possibly affect their decisions if they are solely payoff-maximizing. Following the Senders transmitting a promise and incurring the associated effort cost, their Left/Right choice is determined randomly instead of by the Sender's choice. Receivers know that the Left/Right choice is independent of their paired Sender's decision and thus their message cannot have any information relevant to the Receiver's payoff maximization. This design creates a condition under which we are certain Receivers' beliefs are constant.

The results of Experiment 2 do not support our interpretation of the Experiment 1 results. When the Senders' action is chosen at random, Receivers are not significantly more likely to choose In following a more costly promise. However, we also do not observe a statistically significant increase in trust when the Senders make the Left/Right decision as they do in Experiment 1. Further, we do not find a significant increase in trust rates following promises. This is puzzling given that the effect of promises seen both in the existing literature and in Experiment 1 in this chapter. The lack of impact of promises on their recipients suggests that introducing the potential random mechanism had unintended effects on our subjects. We cannot determine whether Experiment 2's results are a true reflection of subjects' decisions given the information or if they are an artifact of misunderstanding about the random mechanism. In future work, we will investigate these results further, using a redesigned task to ensure clarity and comprehension.

Despite the inconclusive results of Experiment 2, the work presented in this chapter still reveals novel aspects of communication between economic agents. Receivers trust higher-effort messages more frequently, holding the message content constant. This finding may explain part of the outsized effectiveness of free-form communication compared to fixed, prewritten signals. A Sender may craft a message to display effort, increasing their expected payoff in excess of the cost they incur. Determining the reason for this — whether other-regarding towards Senders or payoff-maximizing based on Senders' choices — requires further investigation.

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Appendix

Pairwise comparisons between treatments in Experiment 1

Table 2: Receiver comparison without message

	Low	High	vHigh	xtr
None	0.58	.144	.142	.013
Low		.721	.727	.343
High			.504	.134
vHigh				.127

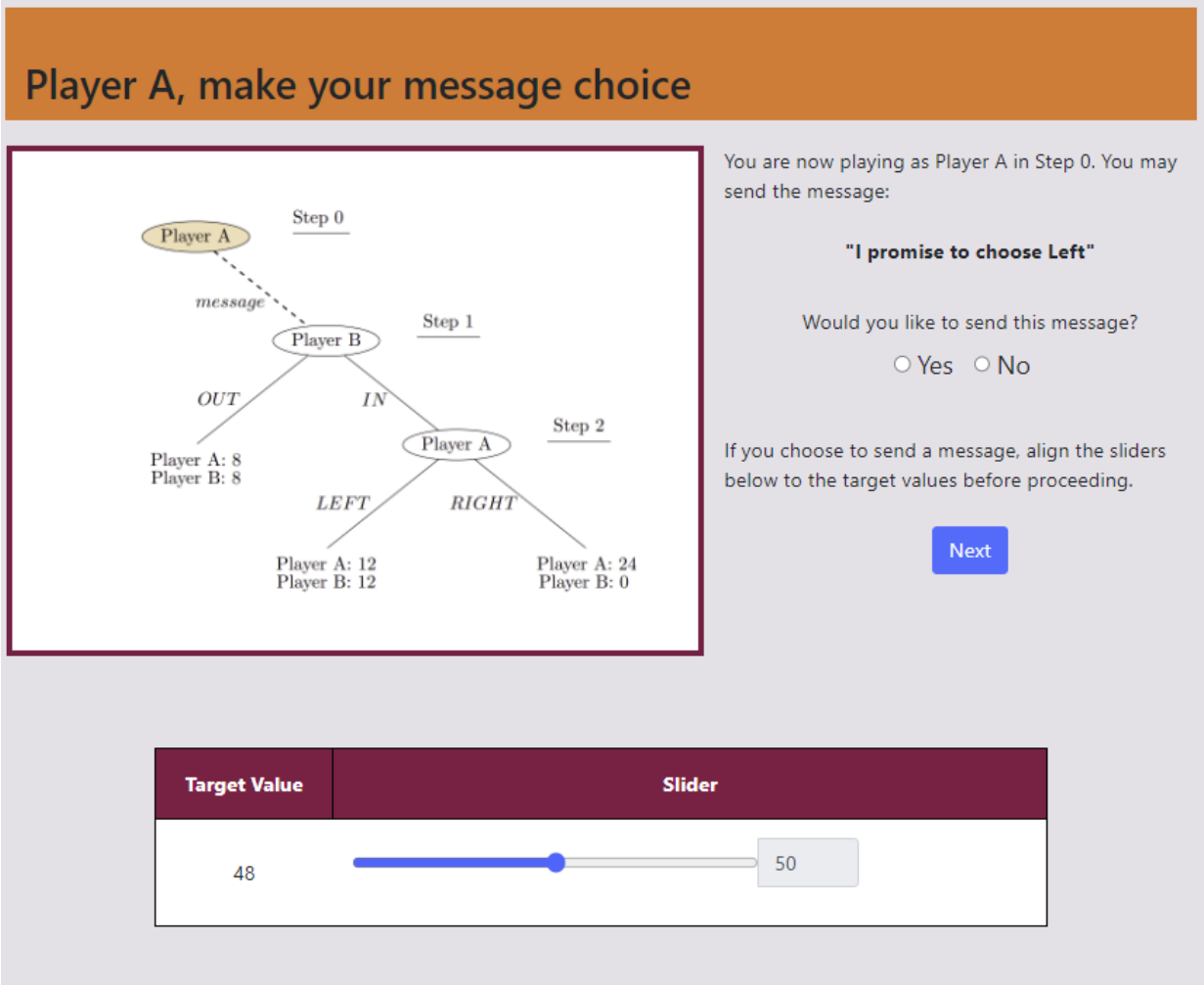
p-values comparing effort levels when no message is sent. P-values are for one-sided t-tests examining whether the mean of the column treatment excedes the mean of the row treatment.

Table 3: Receiver comparison with message

	Low	High	vHigh	xtr
None	.989	.519	.736	.129
Low		.011	.052	.001
High			.723	.118
vHigh				.049

p-values comparing effort levels when a message is sent. P-values are for one-sided t-tests examining whether the mean of the column treatment excedes the mean of the row treatment.

Message interface for both Experiment 1 and 2



Data from NLP and Trust chapter (included only when separating chapters

Table 4: Example Messages: Most and Least Effective

Type	Messages
Most Trusted	I'm going LEFT, so please select IN. This will maximize the earnings for both of us equally. choose IN so that we will both get 12 tokens Choose "In" and I'll make sure we both get 12 tokens! Hi there. I would understand why you would choose OUT, but I promise to make the choice ... I promise you that I will always choose "left" so that we both get 12 points each. Helloo!!! Let's make this work for both of us in the best possible way! Have a great day! Hey, I'm not a greedy person and in these situations, I always choose the most beneficial option for ... You can be sure that i will choose left, as it is the best option for both us. Please go ahead and select 'In' I'm good for the 12. I believe that there are real people here, and I'm completely down with splitting the 24 and ... I'm picking left so if you want a few extra tokens, go for in. Totally understand if you don't but that's my choice. I'm always going to choose "left" because I think it's dickish to screw another player over. I will maximize both our outcomes ie LEFT if you stay in.
Least Trusted	I'm going to choose Right i get 24 you get 0 U GO ON STRITE Hello Let's play the game I want choose Player A hi, how are you doing? Hey. let's work together, let's both choose out. I choose out choose out

A sample of messages trusted by all/none of their recipients. In Chapter 2, each message is sent to 10 recipients. The most and least effective above are a sampling of those which were trusted by all/none of their recipients.