

# Real-effort and Communication v5

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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. Motivated by an observation from a previous study of free-form communication, 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 an experiment in which the sender's message cost has no possible influence on their decision. The results...

# 1 Introduction

Communication encourages cooperation in games well beyond what is expected solely from the players’ monetary payoffs. 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 (Charness and Dufwenberg, 2010). This deviation from standard theory is well established but poorly understood.

The addition of 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 (Ruffle and Tobol, 2017) (Lange et al., 2016). 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 (Gerald et al., 2021). In this paper, we explore a new potential explanation of the out-sized effect of free-form communication: effort-cost.

We focus on 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 promises 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 on the part of the salesperson. 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 paper, we investigate varying levels of effort as a mechanism through which free-form communication achieves its excessive impact. We conduct a trust game experiment with communication between subjects, replacing free-form communication with the option to send a single, fixed message, promising to cooperate, at the cost of completing a real-effort task. We vary the level of required effort and examine the impact on the Recipients’ trust as well as the Senders’ trustworthiness.

## 1.1 Background

### 1.1.1 A Simple Trust Game

We study communication in the context of a simplified trust game, 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 shows the game tree for this interaction.

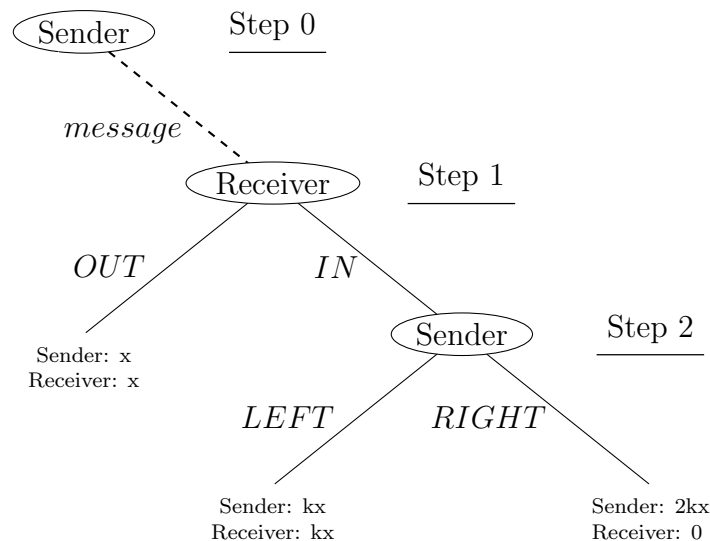


Figure 1: Game tree of a simple trust game.

The Subgame-perfect 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 efficiency gains are undermined by the risk the Receiver must take on based on the Sender's 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). This 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.

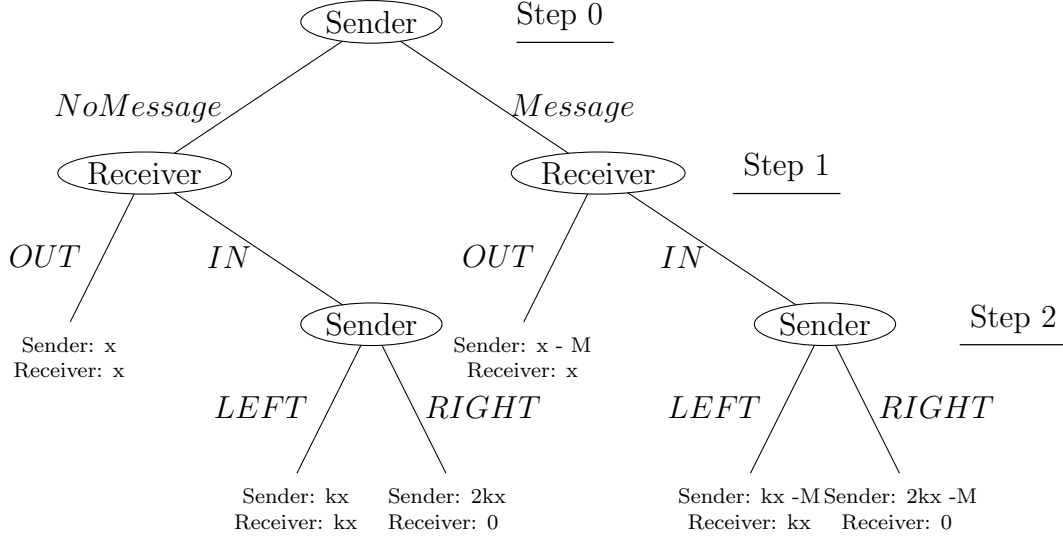


Figure 2: Augmenting the simple trust game with the introduction of a message cost does not change the SPE prediction.

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.

### 1.1.2 Cheap-talk models

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 (Krol and Krol, 2020), (De Haan et al., 2015).

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. For effort cost to impact decisions in the above models, one would need to assume that there exists a type of sender such that values the opportunity to be honest more than their own material payoffs.

### 1.1.3 Communication as public goods experiments

Existing experiments studying costly cheap talk communication with human subjects focus on the presence of costs to establish communication, considering communication as a potential 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; Grözing et al., 2020).

However, in coordination games, communication costs introduce frictions, which harm subjects’ ability to effectively coordinate. These 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 exert lower levels of mean contributions. 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).

### 1.1.4 Other possible confounding features with effort

A thorough review of the literature shows that discussions of links between message costs and recipient trust are scarce. Some literature examines costly apologies and their interpretation by a potential recipient. 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 paper, 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 recipient 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 payoff by incurring the effort cost.

Thus, 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 Sender’s 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 recipients must believe this to be the case. We expect the stated beliefs of recipients regarding the likelihood Senders will share the tokens to increase along with message cost. Recipients 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 recipients about the sender’s actions are the same across all cost levels.

## 2 Experiment 1

### 2.1 Experiment 1: Methods

We conduct a trust game with one-way communication. The game proceeds in two stages between two players the Sender and the Receiver. In stage 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, 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.

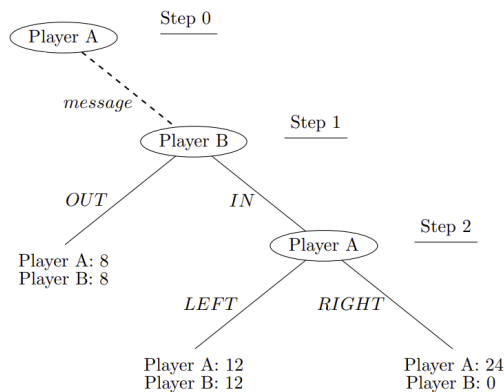


Figure 3: The game tree with payoffs used in experiment 1.

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. 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. 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.

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 MTurk, using a game built on the oTree

framework Chen et al. (2016).

## 2.2 Experiment 1: Results

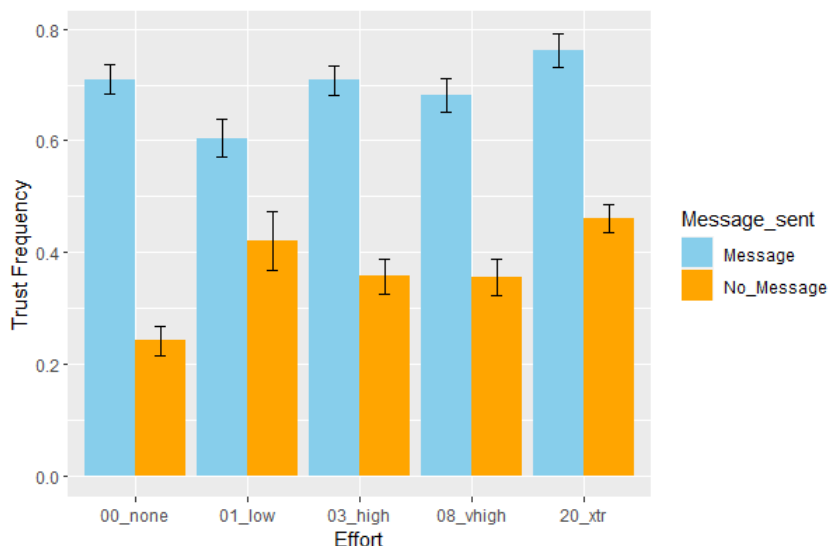
Our data consist of responses from 204 participants. The mean participation time and earnings were 8 minutes and \$ 2.10 respectively. Figures 4 and 5 present the primary results across the five treatment groups.

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, which makes it a more reliable commitment mechanism, which recipients correctly interpret. Our subjects’ choices when acting as Receiver follow the expected pattern. Compared to the Low treatment (1 slider task), recipients of promises requiring High (3), Very High (8), and Extreme (20) levels of effort to send are significantly more likely to choose Left. 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.

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 High and Very High treatments. However, there is no significant difference between the Extreme and the Low treatment.

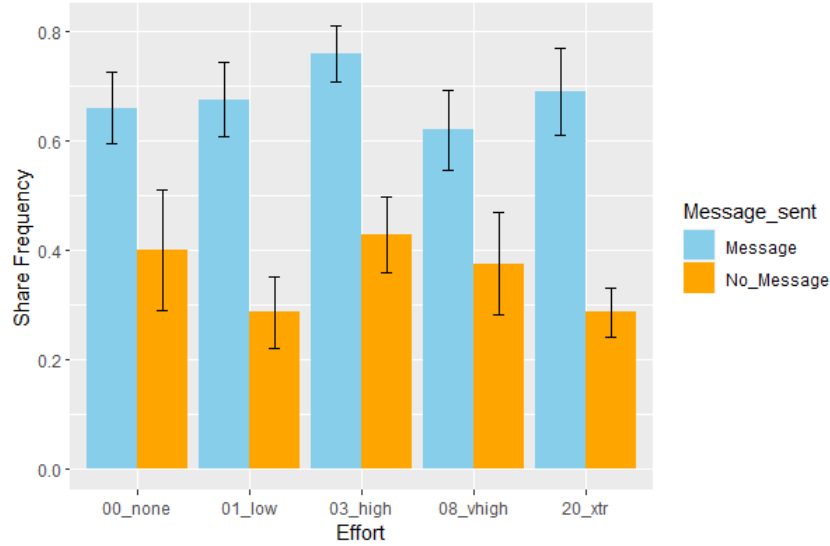
Figure 4: Trust results





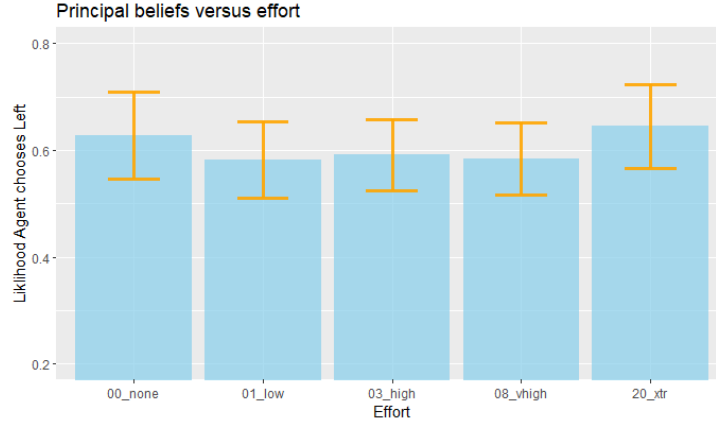
Having seen that Recipients’ trust increases as the effort to send a promise to play Left increases, we now move to the senders’ choices between Right and Left. For our proposed mechanism to hold, the increase in trust from Receivers must be supported by a corresponding increase in trustworthiness from the Senders. Across all 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 differences in the Sender’s Left/Right between any of the five effort level treatments.

Figure 5: Share results



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.

Figure 6: receiver beliefs— Message sent



95% confidence intervals are plotted in orange

We find no evidence of significant differences in subjects’ beliefs between any of our five treatments. This belief agrees 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 one 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 remain constant across all levels of effort. What makes this apparent misalignment between stated beliefs and actions more interesting 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. 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.

## 3 Experiment 2

### 3.1 Procedures

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 choices remain 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 five treatments. As in experiment 1, the five treatments; None, Low, High, Very High, and Extreme; require 0, 1, 3, 8, or 20 slider tasks.

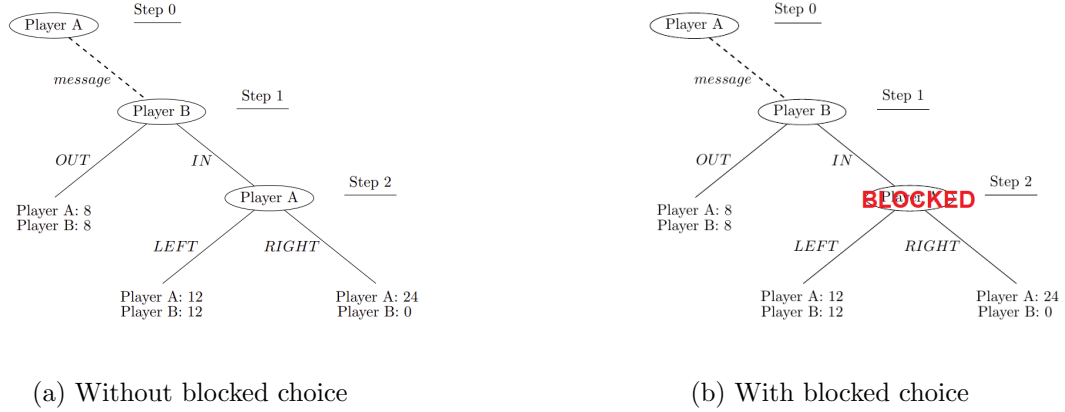


Figure 7: Game trees with and without blocked choice as seen by Receivers

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.

### 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.

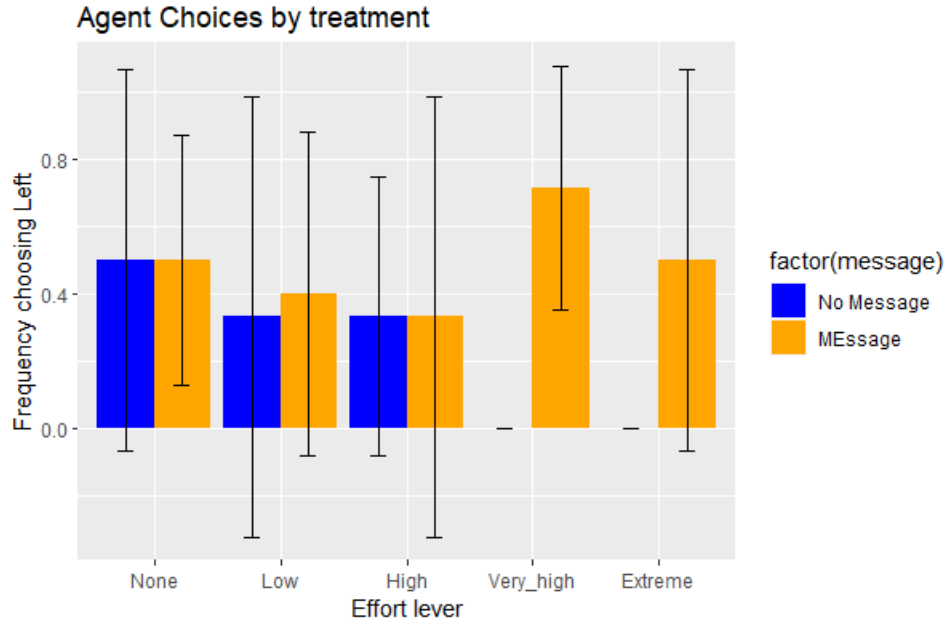
However, the results from experiment 1 suggest that the different levels of effort do not change the Receivers' estimations of the likelihood the Sender will share the tokens. If there truly is no change in beliefs, it implies that Receivers view their choice to pass the tokens as a fixed lottery, regardless 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

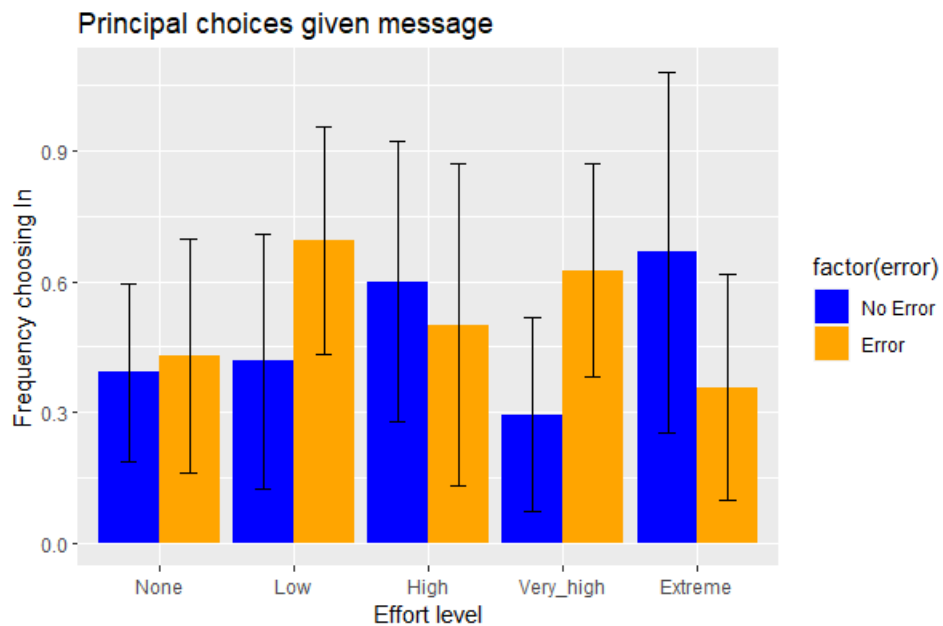
Given our hypothesis motivating experiment two, we expect to observe the following patterns in the graph below

- Our game design claims that the addition of the system error should not impact the senders' choices of message or of Left/Right. Therefore, we expect the same patterns as observed in Experiment 1: no significant changes in the message group and declining trust in the no-message group, if any change is seen at all.



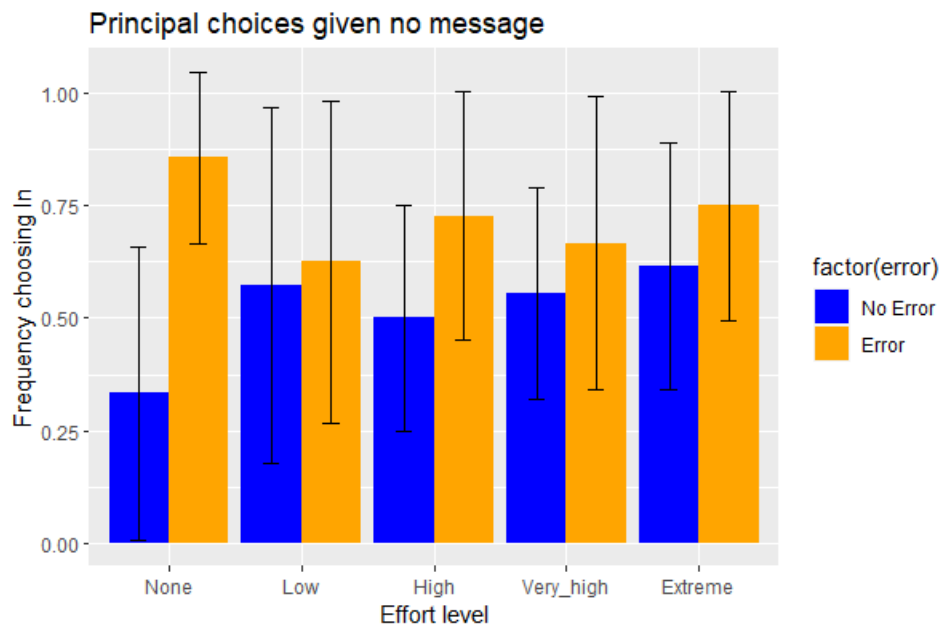
Given our hypothesis motivating experiment two, we expect to observe the following patterns in the graph below

- There should be no difference between this graph and the equivalent one in Experiment 1



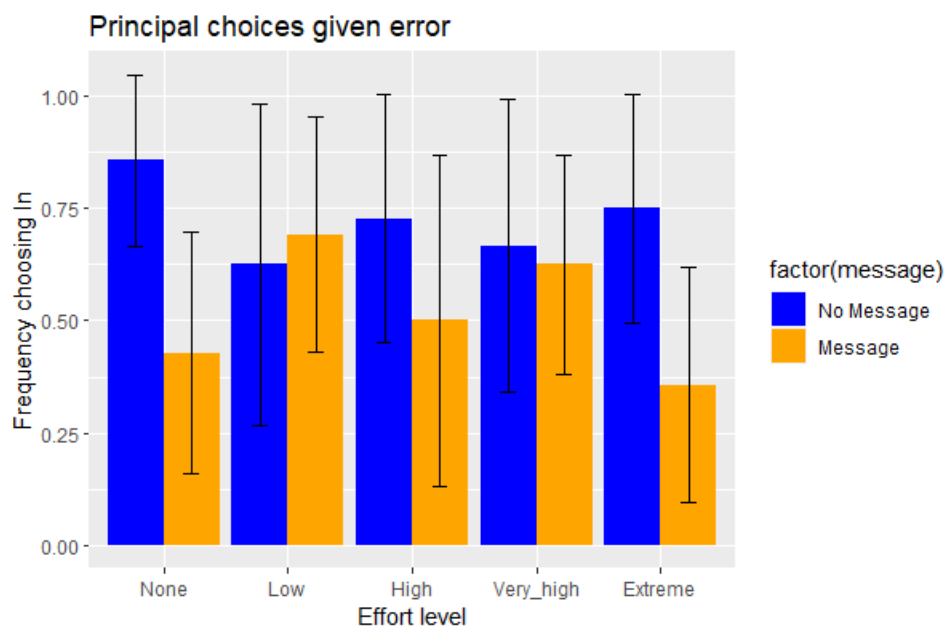
Given our hypothesis motivating experiment two, we expect to observe the following patterns in the graph below

- We expect to see the average trust rate increasing as effort cost increases for both groups.
- They should increase at roughly similar rates, given that estimated beliefs did not change as effort increased.



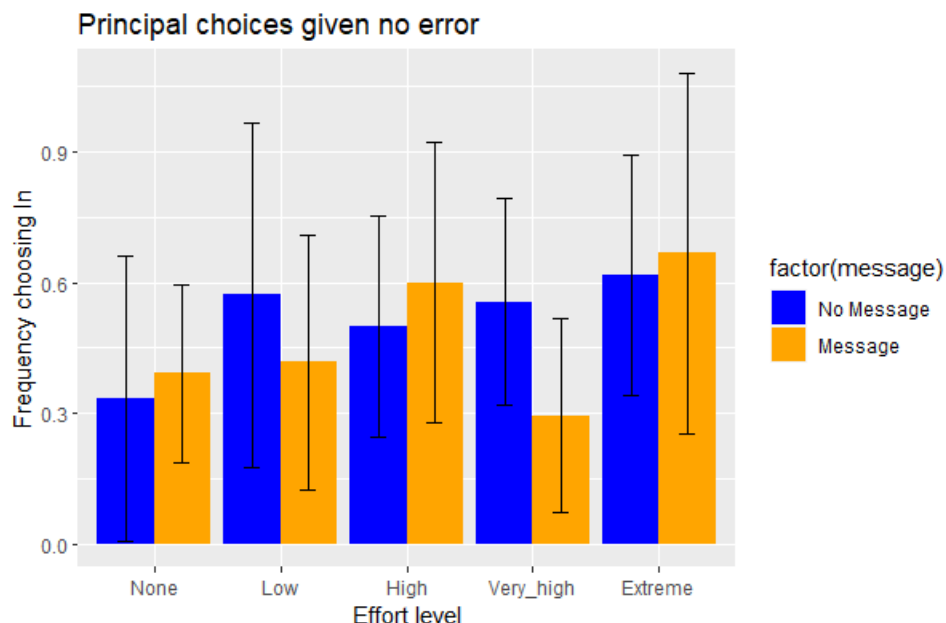
Given our hypothesis motivating experiment two, we expect to observe the following patterns in the graph below

- test



Given our hypothesis motivating experiment two, we expect to observe the following patterns in the graph below

- test



### 3.4 Experiment 2: Discussion

## 4 Conclusion

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## 5 Notes and scratch-work

### 5.1 Notes for transition from experiment 1 to experiment 2

- Cross-cultural experiment showing evidence as trust as a pro-social action without necessarily believing in increased sharing Póvoa et al. (2020)
- Find citations for ultimatum games where the role of the first mover is chosen non-randomly
- Trust as reciprocity after market interactions.
- Existing evidence of trust as a reciprocal or other regarding action
- lying about actions versus information Serra-Garcia et al. (2013)

#### 5.1.1 Overall levels of Trust and Trustworthiness in the market

This section is primarily a placeholder pending results from a second round of sessions. In the initial results, the likelihood that a receiver chooses in, unconditional on whether or not a message is sent, increases along with effort. This is somewhat unsurprising given that we saw trust increasing both with and without a message sent separately. A greater percentage

of senders decline to send a message as their effort cost increases, but this effect is not strong enough to counteract the increases in trust.

Figure 8: Trust unconditional on message

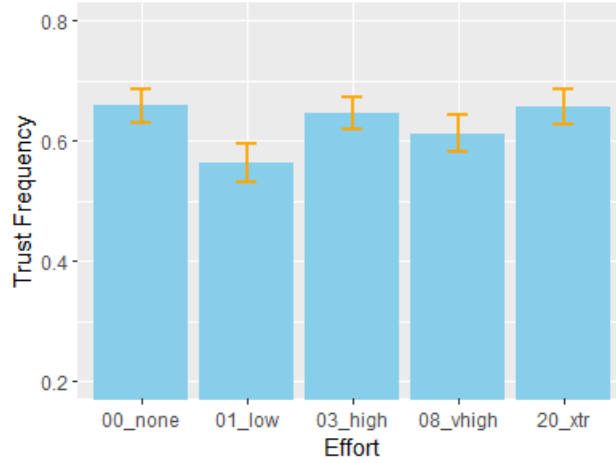
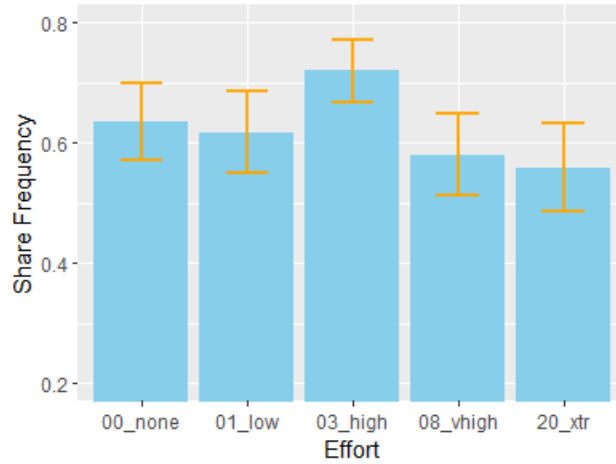


Figure 9: Share unconditional on message



Note

- If the pattern in the above graph, Share unconditional on message choice, holds with greater statistical power, it suggests that there is a causal relationship between sending a promise and choosing to Share. Otherwise trustworthy senders who are dissuaded from sending a promise by the high cost choose not to share the tokens. Presumably, they would have if the promise cost was lower.

## 5.2 Other Experiment 1 observations

- Note the difference between the level of trust and level of trustworthiness in the extreme cost, no message group. Receivers increase their trust in senders declining to send a

message when the cost is extremely high, however, the share rate for the same group is the lowest we observe in any no-message treatment.