COMMUNICATION WITH PARTIALLY VERIFIABLE INFORMATION: AN EXPERIMENT

Valeria Burdea[*], Maria Montero[†], Martin Sefton[‡]

July 6, 2023[§]

Abstract

We use laboratory experiments to study communication games with partially verifiable information. In these games, based on Glazer and Rubinstein (2004, 2006), an informed sender sends a two-dimensional message to a receiver, but only one dimension of the message can be verified. We investigate the effect of evidence and verification control using three treatments: one where messages are unverifiable, one where the receiver chooses which dimension to verify and one where the sender has this verification control. First, we find that evidence helps the receiver. Second, despite significant differences in behavior across the two verification treatments, receivers' payoffs do not differ significantly across these treatments, suggesting they are not hurt by delegating verification control. We also show that a theoretically optimal receiver commitment strategy identified by Glazer and Rubinstein is close to being an optimal response to senders' observed behavior in both treatments.

Keywords: communication, partially verifiable messages, verification control, experiment

JEL: C70, D82

[*]Department of Economics, LMU Munich (valeria.burdea@econ.lmu.de)

[†]School of Economics, University of Nottingham

[‡]School of Economics, University of Nottingham

[§]We are grateful to the associate editor, two anonymous referees as well as Johannes Abeler, Jan Potters and Daniel Seidmann for helpful comments. We would also like to thank participants at GAMES 2016, FUR 2016, SING 2016, CED 2017, the Amsterdam Communication Workshop 2018, the Stony Brook International Conference on Game Theory 2019 and seminar participants at University of the Basque Country, Tilburg University, University of Amsterdam, WZB Berlin and New York University at Abu Dhabi. This work was supported by the ESRC Network for Integrated Behavioural Science (NIBS) [grant number ES/K002201/1]. Ethical approval for the experiments was obtained from the Nottingham School of Economics Research Ethics Committee.
Declarations of interest: none.

1 INTRODUCTION

We report experiments based on partially verifiable information games. In these games a sender (he) is privately informed about a multi-dimensional state and wants to persuade an uninformed receiver (she) to take a certain action. To do so he sends a costless message and the receiver then observes some (but not all) dimensions of the state before taking an action. Thus, the receiver acts on a combination of hard evidence and cheap talk.

Such situations are commonplace, since in practice informed parties often make claims about their private information and it is typically infeasible or prohibitively costly for a receiver to verify all claims. Also, in practice, the verification process varies: in some cases the sender can choose which claims to verify, while in others the receiver can choose what to verify.

For example, consider a job interview where a candidate wishes to persuade an employer to hire him. In some interview formats the candidate may make claims about his various skills, and also be able to demonstrate some (but not all) of these. Which skills will the candidate choose to demonstrate? In other formats the employer may target certain skills and use particular questions to discover the candidate's command of these. As another example, consider a business owner trying to convince an investor to invest in his business. The owner may make claims about the business, but also provide hard evidence to back up these claims (e.g. sales figures, market research reports). Again, which evidence is provided might be determined both by the business owner and the potential investor.

In this paper we investigate experimentally whether providing partial verification of information helps information transmission, and whether information transmission depends on who (sender or receiver) has the power to decide the information that is checked. We do this within the context of games that are based on theoretical models of partially verifiable information (Glazer and Rubinstein, 2004, 2006). As far as we are aware, this is the first experimental study of strategic information transmission in which both cheap talk and hard evidence are present.

In the games that we study the state of the world is based on the values of two aspects which are known to the sender, but not to the receiver. The sender's type is good if the sum of the two aspects is sufficiently high and bad otherwise. The receiver maximizes her payoff when accepting good types and rejecting bad types while all sender types want the receiver to accept.

Our baseline setting is a simple cheap talk game in which no hard evidence is available. The sender sends a message about the values of the two aspects to the receiver, who then chooses to either accept or reject. Standard equilibrium analysis predicts that cheap talk will be uninformative in this setting and the receiver's equilibrium strategy will depend only on the prior probability that the state is good. Nevertheless, previous experimental evidence of overcommunication in sender-receiver games (see Blume et al., 2020, for a review) shows that senders' messages are often more informative than is consistent with equilibrium theory. Our baseline setting allows us to establish the extent of information transmission due to cheap talk. We also study two other games which add hard evidence to this baseline.

Our "Receiver-Verifies" game is based on the model introduced in Glazer and Rubinstein (2004). In this game, after observing the sender's message and before taking her action, the receiver chooses one of the aspects and observes the value of this aspect. In any equilibrium of this game some information is transmitted and the receiver's payoff is higher than in the equilibrium of the baseline setting. This is because the receiver can always choose to ignore the sender's message, inspect one of the aspects at random and obtain information that allows her to make a more informed guess about the state. This places a lower bound on the amount of information transmitted and the receiver's payoff in equilibrium. There are other equilibria where the receiver's strategy uses the message to decide which aspect to verify and/or how to react to the observed value. Glazer and Rubinstein (2004) use a mechanism design approach to identify a receiver's optimal strategy assuming that the receiver is able to commit to a strategy. The game we implement is an extensive-form game in which the receiver cannot commit. Nevertheless, it has a sequential equilibrium where the receiver uses an optimal commitment strategy and attains the optimal payoff of the game with commitment (Glazer and Rubinstein, 2004, section 7).

We also study a "Sender-Reveals" game, which differs from the Receiver-Verifies game in that the sender decides which aspect will be observed by the receiver. This game is based on the model introduced in Glazer and Rubinstein (2006) (except that in their model there are no messages and the receiver can commit to a strategy). This game also has many equilibria. The worst equilibrium for the receiver reproduces the equilibrium outcome of the baseline setting. Thus, in this equilibrium, and in contrast to the Receiver-Verifies game, evidence does not help the receiver. However, there are more informative equilibria. Glazer and Rubinstein show that the payoff from the receiver's optimal commitment strategy is the same as in the model where the receiver decides which aspect to verify. Again, although our laboratory extensive form game does not allow the receiver to commit, it has a sequential equilibrium in which the receiver uses the optimal commitment strategy and obtains this optimal payoff.

In summary, in both partial verification games there are multiple equilibria. The most informative, in the sense of inducing the finest partition of the set of states, gives the receiver her highest equilibrium payoff and is the same in both games. Thus, if players coordinate on this equilibrium it does not matter to the receiver who has verification control. However, it is possible that players coordinate on other, less informative equilibria. Moreover, it is possible that actual play is inconsistent with any equilibrium. Just as overcommunication enables receivers to exceed their maximal equilibrium payoff in cheap talk games, it may be that receivers can benefit from overcommunication in the games with evidence. At the same time, senders' messages may convey less information in a treatment where information can be verified than in the baseline, and it is even conceivable that more information is transmitted without than with verification. Our experiment allows us to observe how the games are actually played, whether evidence is beneficial to the receiver and, if so, whether control of the verification process is beneficial to the receiver.

In our baseline treatments most senders report their type as good, although some bad types do truthfully report. Given this, the receiver's best response to a sender who reports their type as bad is to reject, while the best response to a sender who reports their type as good is to essentially ignore the message and base the acceptance decision on the prior probability of a good type. We observe overcommunication which allows a best-responding receiver to do better than the equilibrium. But, because receivers do not always follow the best response they end up earning close to the equilibrium payoff.

When we introduce evidence, we find that receivers benefit: they earn significantly more in both evidence games than in the baseline. The evidence observed by receivers depends on who controls verification. In Sender-Reveals senders almost always reveal their higher aspect and so receivers observe the aspect that is more favorable to the sender in terms of pointing toward a good type and acceptance. In Receiver-Verifies receivers observe the higher aspect much less often. This is because receivers check the lower claim about a third of the time. Indeed, the receiver's strategy is reminiscent of a random auditing strategy. Next, the way receivers condition their action on the evidence differs across games. In Sender-Reveals the receiver bases her action mainly on whether the observed aspect is sufficiently high, while in Receiver-Verifies she bases her action on whether the evidence matches the sender's claim. However, despite these differences in information transmission, receiver payoffs do not differ significantly across the evidence games, and so receivers neither gain nor lose by having verification control.

Our experiment complements the analysis of optimal receiver strategies in Glazer and Rubinstein (2004, 2006). Whereas they identify optimal commitment strategies for a receiver facing a sender who best responds to the receiver's strategy, we compare the performance of several hypothetical receiver strategies against the empirically observed sender behavior. In both treatments, we identify one of the theoretically optimal commitment strategies that performs best. Specifically, in Sender-Reveals, receivers should accept if the sender claims to be a good type and presents strong enough evidence. In Receiver-Verifies, receivers should check the highest claim and accept if the sender claims to be a good type, no misreport is observed and the observed aspect is strong enough. In both treatments these strategies are close to being the receiver's best response against the observed sender behavior. These strategies are difficult for senders to exploit, and at the same time allow receivers to take advantage of truthful senders.

The rest of the paper is organized as follows. In Section 2 we discuss the related literature. In Section 3 we describe the baseline and the partially verifiable information games and their equilibria in detail. Section 4 describes how we implement these games in the lab and presents the experimental design. In Section 5 we report the results of our experiment. Section 6 concludes.

2 RELATED LITERATURE

Our experiment studies strategic communication in a setting where an informed sender can send messages about private information and these messages are partially verifiable. Thus, our paper combines elements of cheap talk games and verifiable message games.

A substantial experimental literature has examined cheap talk games based on the model of Crawford and Sobel (1982) (see Blume et al., 2020, for a review). In these games, a privately informed sender sends a message to a receiver who then takes an action that directly affects both players' payoffs. A robust finding in this literature is that senders overcommunicate (see, for e.g., Cai and Wang, 2006) - revealing the state truthfully more often than theory would suggest.[1] The first way in which the games we study differ from the Crawford and Sobel (1982) cheap talk game is in the dimensionality of the state and message spaces. Whereas the Crawford and Sobel (1982) cheap talk game involves unidimensional states and messages, in our games these are bi-dimensional: a sender is privately informed about two aspects and sends a message about each of these.[2] The second way in which the games we use differ from a cheap talk game is that messages are coupled with evidence. In Sender-Reveals the sender chooses one aspect to reveal, and so they can back up their message with some evidence. In Receiver-Verifies the receiver chooses one aspect to verify and so they can investigate the sender's claims. We see no reason why evidence would eliminate the overcommunication observed in simpler cheap talk games, but also no reason why verification control would lead to different overcommunication rates.

Our Sender-Reveals game has elements in common with verifiable message (disclosure) games, where a sender's message space is type-dependent so that a given message may provide hard evidence about a sender's type. Most experimental studies of disclosure games have been based on the models of Milgrom (1981) and Grossman (1981), where the sender's preferences are monotonic in the receiver's action and the sender can choose to (but need not) fully reveal their type. A key theoretical result from these models is that a fully informative equilibrium exists (the "unravelling principle"). Experimental studies (see e.g. Forsythe et al., 1999; Li and Schipper, 2020; Montero and Sheth, 2021; Sheth, 2021) find that senders don't always reveal their type as theory would suggest (following the unravelling principle) although repetition and feedback enhance the degree of unravelling (Forsythe et al.,

[1] This behavior could be explained if some senders incur psychological lying costs which outweigh the benefit of lying. Such preferences have been documented in many studies of individual decision making (for a review, see Abeler et al. (2019) and Gerlach et al. (2019)). Note, however, that some papers studying cheap-talk games (e.g. Minozzi and Woon, 2013; Sánchez-Pagés and Vorsatz, 2007) find lying rates much higher (close to 80%) than the typical rate (around 20%, Abeler et al. (2019)) in individual decision-making settings.

[2] A few previous studies (e.g. Lai et al., 2015; Vespa and Wilson, 2016), have focused on multi-dimensional cheap talk (as modeled in (Battaglini, 2002)), but this type of cheap talk game is quite different from ours as it involves multiple senders and, due to this, it has equilibria where messages are fully informative.

1989; Jin et al., 2021; King and Wallin, 1991). These studies also show that receivers are not sufficiently skeptical about undisclosed information. This lack of skepticism could translate, in our setting, into higher acceptance rates than equilibrium theory would predict.

The games we use differ from these games in that we force partial disclosure (whereas in the verifiable message games discussed above senders may also remain silent or fully reveal their type). This means that the unraveling principle does not apply. There are a few other studies of disclosure games where unravelling is not necessarily predicted in equilibrium. Hagenbach and Perez-Richet (2018) conduct treatments with multiple equilibria where in some treatments these include fully revealing equilibria. Their focus is on how the structure of the sender's incentives (a graph specifying which types have incentives to masquerade as which other types) affects behavior and outcomes, whereas we retain a standard pattern of incentives and focus on partial disclosure. Benndorf et al. (2015) study games with costly disclosure where some types do not fully disclose in equilibrium. They find that equilibrium play is more likely when subjects are predicted to conceal than when they are predicted to reveal their type. Penczynski and Zhang (2018) investigate disclosure when there is uncertainty about the available evidence, in which case fully revealing equilibria are not possible (Shin, 1994, 2003). They compare a monopoly setting, where the receiver reports her willingness to pay after receiving the sender's message, with a competitive setting, where the receiver can choose which sender to interact with and then reports her willingness to pay after receiving four senders' messages. They find that receivers' skepticism is lower in the competitive setting. One possible explanation discussed by the authors is that the act of choosing one sender might give receivers an illusion of control and make them optimistic about the selection of evidence that they face. Analogously, in our experiment, receivers who actively choose which aspect to observe may be less skeptical than when the sender has verification control.

Only a few theoretical studies combine elements of both cheap talk games and disclosure games. Among these, Lipman and Seppi (1995) examine the role of competition between senders in a model where information is partially verifiable while Forges and Koessler (2005) characterize the equilibrium set of such games when a communication mediator is present. Though these aspects seem useful in increasing the amount of reliable information the receiver can extract from the sender, in this paper we focus solely on two-person interactions, based on theoretical models introduced by Glazer and Rubinstein (2004, 2006). Carroll and Egorov (2019) provide a theoretical analysis of situations that are similar to those studied in Glazer and Rubinstein (2004) and hence our Receiver-Verifies game. They find that for a specific class of sender payoff functions the receiver can learn the sender's private information fully. The models that we consider in this study do not belong to this class. We discuss the Glazer and Rubinstein (2004, 2006) models in detail below.

Glazer and Rubinstein (2004) analyze a situation where a sender is privately informed about a multi-dimensional state of the world and sends a message about this to a receiver.[3] The receiver then chooses a single dimension of the state to observe, and can thus verify part of the message, before taking one of two actions, Accept or Reject. The sender prefers the receiver to accept independently of the state, whereas the receiver's optimal action depends on the state. The authors identify optimal mechanisms from the receiver's point of view, i.e. mechanisms that maximize the receiver's expected payoff, when the receiver can commit. Glazer and Rubinstein (2006) modify this model by removing messages and the receiver's option to verify and instead allowing the sender to reveal truthfully one dimension of the state. They show that the receiver's optimal mechanism in this case yields the same expected payoff to the receiver. Thus, theoretically the receiver does not suffer by losing verification control.

Glazer and Rubinstein (2004, 2006) also discuss the corresponding extensive form games where the receiver cannot commit to a strategy. In both settings they show that the receiver's payoff from the optimal mechanism can still be achieved in a sequential equilibrium of these games. Our study is designed to test the effect of losing verification control on the receiver's payoff in these extensive form games. In the next section we discuss this setup in more detail.

3 PARTIALLY VERIFIABLE INFORMATION GAMES

We study three games. In all games the sender's type is determined by the value of two aspects, and the privately-informed sender makes a claim about the values

[3] Glazer and Rubinstein (2004) refer to this setting as a persuasion game. This is not to be confused with the Bayesian persuasion games of Kamenica and Gentzkow (2011). These are sender-receiver games where the sender can commit to a message strategy (see Fréchette et al. (2022) and Aristidou et al. (2019) for experiments that allow sender commitment). In contrast, Glazer and Rubinstein (2004) do not allow sender commitment in their model.

of these aspects. In the Baseline game (BASE), the receiver then decides whether to accept or reject. Hence, in this game, the sender's claim is unverifiable. In the Receiver-Verifies game (RV), after observing the sender's claim, the receiver chooses one of the aspects to be checked and, after observing the actual value of that aspect, decides whether to accept or reject. In the Sender-Reveals game (SR), after the message is sent, the sender decides which aspect is observed by the receiver. Hence, the partially verifiable information games differ only in who controls the verification process. As we will discuss below, the partially verifiable information games have multiple equilibria, and so we focus on the receiver's optimal equilibrium to establish a benchmark against which we can compare the behavior observed in our experiment. The receiver's payoff in such an equilibrium is the same as in an equilibrium of maximum informativeness, where informativeness can be measured by how fine the partition of the state space is. Since the receiver only needs to know whether the hand is good or bad, finer partitions do not necessarily increase receiver payoffs, but the receiver weakly benefits from a finer partition. Each of the three games is formally described below.

3.1 *The Baseline game (BASE)*

There are two players: a sender and a receiver. The sender's type depends on the values of two *aspects*. Aspect $i = 1, 2$ is a random variable that can take values in the set $X_i = \{1, ..., 9\}$. The set of possible types is then $X = X_1 \times X_2$. A generic element of X will be denoted as $x = (x_1, x_2)$. The probability of type $x \in X$ is denoted as $p_x = \frac{1}{81}$. The sender's type is "good" if x belongs to the set G, where $G = \{(x_1, x_2) | x_1 + x_2 \geq T\}$; and "bad" otherwise. We consider two different parametrizations for the threshold that determines a good hand, T = 11 and T = 9. We refer to these parametrizations as T11 and T9 in our analysis. Thus, in T9 there are more good hands than bad ones, while in T11 more bad hands than good ones.

The T11 parametrization is taken from an online experiment of Glazer and Rubinstein at https://arielrubinstein.org/gt/. In their experiment, the receiver is a computerized player playing an undisclosed strategy. Having a relatively large type space with 9 possible values of each aspect allows us to better differentiate between equilibria with no informative messages and the most informative equilibria. As we will see below, in both types of equilibria the receiver accepts if the value observed is above a cutoff value. Having a larger type space allows a different cutoff value for different equilibrium types, and neither cutoff coincides with the maximum possible value of an aspect, and so receiver behavior may deviate from the prediction in both directions.

Payoffs depend on type and action, as summarized in Table 1. The receiver wants to take action a ("accept") if the sender's type is good, and action r ("reject") if the sender's type is bad. The sender always wants the receiver to take the action a, irrespective of type. Note that the receiver's utility is 1 if the optimal action has been chosen (i.e., if either $x \in G$ and a has been taken, or $x \in X \backslash G$ and r has been taken) and 0 otherwise. Hence, both types of errors (rejecting a good type and accepting a bad type) are assumed to be equally costly for the receiver, and an expected utility maximizing receiver minimizes the probability of making an error.

Table 1: Payoff Matrix (sender's payoff listed first in each cell)

	Receiver accepts	Receiver rejects
Good type	(1, 1)	(0, 0)
Bad type	(1, 0)	(0, 1)

The timing of the game is as follows. First, the sender's type is realized and observed by the sender only. Then, the sender sends a message. The set of available messages is denoted by M, and a generic element of M will be denoted by $m = (m_1, m_2)$. A (mixed) strategy for the sender is a function $\sigma : X \to \Delta M$. We assume that the set of messages coincides with the set of types, i.e., $M = X$, but we will keep the notation M to refer to the set of messages for the sake of clarity. We denote the probability that the sender sends message m when the sender's type is x by $\sigma(m|x)$. The receiver's acceptance strategy is denoted by $d : M \to [0, 1]$, where $d(m)$ is the probability that the receiver accepts conditional on receiving message m.

3.1.1 *Equilibria of BASE*

Our equilibrium concept is sequential equilibrium. A sequential equilibrium consists of strategies and beliefs such that (1) at any information set, the player who has the move is playing a best response, given the beliefs and assuming that players will subsequently stick to their strategies (sequential rationality) (2) beliefs are determined by Bayes' rule and the players' equilibrium strategies (consistency of beliefs)[4]. Given that there are more good hands than bad hands in T9, while the opposite is true in T11, the optimal acceptance decision for the receiver given the prior is to accept in T9 and reject in T11. Cheap talk does not change this decision in equilibrium (see Appendix B for details). Equilibrium predictions concerning messages are less sharp. It is not necessarily the case that messages are independent of the sender's type; however, any correlation between type and messages should not result in a change in the receiver's optimal strategy according to the prior.

3.2 *The Receiver-Verifies game (RV)*

The Receiver-Verifies game is based on Glazer and Rubinstein (2004). It differs from the Baseline game in that, after observing the sender's message, the receiver decides which aspect to check and which action to take depending on the message and on the value of the aspect that has been observed. As in the Baseline game, the strategy of the sender is a function $\sigma : X \to \Delta M$.

The strategy of the receiver $f = (\pi, d)$ consists of:

- A *checking rule* that determines which aspect to check after receiving the message. The function $\pi_1 : M \to [0, 1]$ denotes the probability of checking aspect 1 as a function of the message received (the receiver must check exactly one aspect, hence $\pi_2 : M \to [0, 1]$ satisfies $\pi_2(m) = 1 - \pi_1(m)$ for all $m \in M$).

- A *decision rule* for each aspect that determines the probability of acceptance depending on the message received and the value observed. We denote by $d_k : M \times X_k \to [0, 1]$ the probability of accepting after checking aspect k as a function of the value observed and of the message.

An example strategy for the receiver would be the *fair random strategy* (analogous to the fair random mechanism of Glazer and Rubinstein (2004)) where $\pi_1(m) = \pi_2(m) = 0.5$, and $d_k(m, x_k) = 1$ if and only if $m \in G$ and $x_k = m_k$; that is, the receiver checks one aspect at random and accepts when the sender claims to be of a good type and the observed value coincides with the message.

[4] If all information sets can be reached given the strategies, beliefs are completely determined by Bayes rule. If not, sequential equilibrium requires that the strategies and beliefs are found as the limit of a sequence of fully mixed strategies together with the beliefs that follow from those strategies using Bayes rule.

3.2.1 *Equilibria of RV*

Note that there are two opportunities for the receiver to update the prior beliefs in RV: after the message is sent, and after the value of an aspect has been observed. In the first case, the updating of the prior may determine which aspect to check; in the second case, the updating of the prior may determine which action to take. See Appendix A for further details regarding the structure of a sequential equilibrium in the RV game.

The RV game has multiple equilibria. First, there is a family of equilibria which results in the outcome described below.

Definition 1 (GR outcome) *Sender types are accepted if and only if at least one aspect takes a value of at least 7 (T11) or 6 (T9).*

We refer to it as the *GR outcome*, since this is also the outcome resulting from an optimal receiver commitment strategy as analyzed in Glazer and Rubinstein (2004) (see Appendix C). It follows that these equilibria achieve the receiver's maximum equilibrium expected payoff.

Definition 2 (GR equilibrium in RV) *A GR equilibrium is any sequential equilibrium of the RV game that results in the GR outcome.*

The following is an example of a GR equilibrium in RV11 (a detailed discussion is given in Appendix D.1.2). The sender sends a message as shown in Table 2 below. In this table, senders with a good type report it truthfully, while some senders with a bad type inflate their lower aspect. The precise messaging strategy has been constructed so that the following receiver strategy is optimal. The receiver checks the higher claim ($\pi_1 = 1$ if $m_1 > m_2$; $\pi_1 = 0.5$ if $m_1 = m_2$ and $\pi_1 = 0$ if $m_1 < m_2$) and, conditional on this checking behavior, accepts if and only if the observed value is at least 7 (henceforth 7+), a good type is reported and the observed value coincides with the claimed value ($d_i = 1$ if $m_1 + m_2 \geq 11$, $x_i = m_i$ and $x_i \geq 7$; otherwise $d_i = 0$). This is the most informative equilibrium in the sense that it induces the finest partition of the state space .

Given this receiver strategy, senders without a 7+ aspect are rejected irrespective of their message, while senders with a 7+ aspect can be accepted by sending an

Table 2: Example of an equilibrium sender's message strategy in RV11

x_2 \ x_1	1	2	3	4	5	6	7	8	9
9	(2,9)	(2,9)	(3,9)	(4,9)	(5,9)	(6,9)	(7,9)	(8,9)	(9,9)
8	(3,8)	(4,8)	(3,8)	(4,8)	(5,8)	(6,8)	(7,8)	(8,8)	(9,8)
7	(4,7)	(5,7)	(6,7)	(4,7)	(5,7)	(6,7)	(7,7)	(8,7)	(9,7)
6	**(5,6)**	**(6,6)**	**(7,6)**	(4,6)	(5,6)	(6,6)	(7,6)	(8,6)	(9,6)
5	**(7,5)**	**(6,5)**	(3,5)	(4,5)	(5,5)	(6,5)	(7,5)	(8,5)	(9,5)
4	**(8,4)**	**(7,4)**	(3,4)	(4,4)	(5,4)	(6,4)	(7,4)	(8,4)	(9,4)
3	**(8,3)**	(2,3)	(3,3)	(4,3)	(5,3)	**(6,7)**	(7,6)	(8,3)	(9,3)
2	**(9,2)**	(2,2)	(3,2)	**(4,7)**	**(5,6)**	**(6,6)**	(7,5)	(8,4)	(9,2)
1	(1,1)	**(2,9)**	**(3,8)**	**(4,8)**	**(5,7)**	**(6,5)**	(7,4)	(8,3)	(9,2)

Note: Gray-highlighted messages are bad hands profitably lying (since they are accepted). Messages in bold are bad hands lying even though they are rejected.

appropriate message. The gray-highlighted messages in Table 2 are sent by bad types with a 7+ aspect, who best respond to the receiver strategy by inflating the value of the lower aspect, while keeping the claim below the value of the higher aspect, so that the highest claim remains truthful. These types are profitably lying. Good types with a 7+ aspect tell the truth and are accepted.

Note that in this equilibrium the receiver observes a 7+ aspect if the sender's type includes one. Indeed, this is a general feature of GR equilibria: the receiver always observes an aspect with a value above a certain cutoff (7+ for T11, 6+ for T9) if there is one.[5]

Remark 1 *In all GR equilibria of RV, the receiver observes a 7+ aspect (T11) or a 6+ aspect (T9) if the sender's type includes one.*[6]

There are also many sequential equilibria that lead to different outcomes and lower payoffs to the receiver. For example, an equilibrium giving the receiver their lowest equilibrium payoff involves the sender sending a message at random, the

[5]Messages play a crucial role in directing the receiver to observing this aspect in all GR equilibria. They may or may not play a role in the acceptance decision; see Appendix D.

[6]To see this is true, suppose, by contradiction, that there is a sequential equilibrium of RV11 resulting in the GR outcome where the receiver does not always observe a 7+ aspect if there is one. This implies that there is a sender type with exactly one 7+ aspect that is always accepted (GR outcome) despite the receiver observing the other aspect with positive probability. For concreteness, suppose this hand is $(7,6)$. If the second aspect is observed with positive probability, the sender type $(7,6)$ is sending a message that induces the receiver to check the second aspect (i.e. 6) with positive probability, and then accept with certainty (GR outcome). A hand of type $(x,6)$ with $x < 7$ would then have a profitable deviation to sending the same message as $(7,6)$ and be accepted with positive probability, while by assumption it is currently rejected for sure according to the GR outcome.

receiver checking an aspect at random and accepting if and only if the observed value is 6+ (T11) or 4+ (T9). While this leads to the lowest equilibrium payoff for the receiver, it is still above the receiver's equilibrium payoff in Baseline. Both players earn a lower payoff than in the GR outcome in this equilibrium.

There are also equilibria in which the sender is better off than in the GR outcome while the receiver is worse off. In both T9 and T11, the best equilibrium for the sender is such that all good hands are accepted, hence this equilibrium also maximizes total payoffs (see Appendix E for details).

3.3 *The Sender-Reveals game (SR)*

The Sender-Reveals game is based on Glazer and Rubinstein (2006).

The strategy of the sender $g = (\sigma, \rho)$ consists of:

- A *message rule* that determines the message as a function of type. As in RV, we denote the message rule as $\sigma : X \to \Delta M$ and the probability of sending message m as a function of type as $\sigma(m|x)$.

- A *revelation rule* that determines which aspect is to be observed by the receiver depending on the message and on the type. The function $\rho_1 : X \times M \to [0,1]$ denotes the probability of revealing aspect 1 as a function of type and of the message. Since exactly one aspect is revealed, $\rho_2(x,m) = 1 - \rho_1(x,m)$.

The receiver's strategy consists of a decision rule for each aspect, that is, $d_k : M \times X_k \to [0,1]$ for $k = 1,2$. Given the aspect k to be observed, the receiver strategy determines the probability of acceptance as a function of the message m and the value of the aspect observed x_k.

3.3.1 *Equilibria of SR*

The SR game also has multiple sequential equilibria. As in RV, there is a family of equilibria which results in the GR outcome, that is, senders being accepted if and only if at least one aspect takes a value of 7+ (T11) or 6+ (T9) (see Appendix D.2).

Also as in RV, this is the outcome that results from a receiver optimal commitment strategy (see Appendix C).

Definition 3 (GR equilibrium in SR) *A GR equilibrium is any sequential equilibrium of the SR game that results in the GR outcome.*

Like in RV, the equilibria in this family (GR equilibria) differ in the role of messages. In some of these equilibria, the sender displays the higher of the two aspects and sends an uninformative message (e.g., sends a message at random, or always sends the same message). The receiver best responds by accepting if and only if the observed value is 7+.

There are also GR equilibria where messages inform the acceptance decision. Again analogously to RV, consider the following strategy combination. The sender shows the higher of the two aspects and uses the messaging strategy in Table 2. The receiver accepts if and only if a good type is reported, the observed value coincides with the reported value and the observed value is 7+ ($d_i(m, x_i) = 1$ if $x_i \geq 7$, $m_1 + m_2 \geq 11$ and $x_i = m_i$; $d_i(m, x_i) = 0$ otherwise for $i = 1, 2$). As in RV, this is the most informative equilibrium in that it leads to the finest partition of the set of states available to the receiver at the time of the acceptance decision.

Remark 2 *In all GR equilibria of SR, the sender shows a 7+ aspect (T11) or 6+ aspect (T9) if their type includes one.*

There are also equilibria resulting in different outcomes and a lower payoff for the receiver. Some of these give a lower payoff for the sender. For example, the following equilibrium gives the sender a 0 payoff in T11. Senders with good types reveal their lower aspect, while senders with bad types reveal their higher aspect (if both aspects are equal, senders reveal an aspect at random), and all types send a message at random. Given this sender strategy, the receiver best responds by rejecting irrespective of the value of the aspect observed. Given that the receiver is rejecting whatever she observes, the sender has no incentive to deviate. This equilibrium also establishes the receiver's lowest equilibrium payoff (see Appendix E for details). Other equilibria result in a higher payoff for the sender than the GR outcome. Appendix E describes an equilibrium which results in types being accepted if and only if the sender has a 6+ (rather than 7+) aspect for T11. This is the best equilibrium for the sender and, since it results in all good types being accepted, it maximizes total payoffs.

For T9, there are also equilibria that give a lower payoff to the receiver. As for T11, the worst equilibrium for the receiver mimics the outcome when no evidence is available; the difference is that for T9 this results in all types of sender being accepted and hence the sender's best equilibrium (as well as maximizing total payoffs). There are also equilibria where both the sender and the receiver are worse off (see Appendix E.2.1 for details).

3.4 *Hypotheses*

In our setting, incomplete information limits the receiver's ability to identify the state and take the action that leads to her high payoff. If no information is transmitted the receiver has to rely on her prior to choose between actions and her expected payoff depends on this prior probability. More information allows her to better distinguish between states, increases her chances of attaining her high payoff, and increases her expected payoff. In the case where she is fully informed of the state, she can attain her high payoff with certainty. For this reason, a natural measure of information transmission in our setting is the receiver's expected payoff, and we formulate hypotheses concerning this. [7]

Our hypotheses are based on the theoretical considerations described in the previous sections. For the BASE treatments there is a clear equilibrium prediction concerning the receiver's expected payoff. For the evidence games the multiplicity of equilibria makes some selection necessary. We focus on the GR equilibria as they maximise the receiver's equilibrium payoff, and therefore establish a benchmark of maximal information transmission consistent with equilibrium.

[7] There are other measures of information transmission that are appropriate in other settings, such as the sum of sender and receiver payoffs and the correlation between types and actions. In our setting it is problematic to use the sum of payoffs as a measure of informativeness as the sum only depends on actions taken for good sender types. For example, in BASE9 the sum of payoffs is maximised in the pooling equilibrium. If the sender were to truthfully report their type and the receiver were to best respond this would lead to a lower sum of payoffs, even though it is a clear case of information being transmitted. The correlation between types and messages/actions is an appropriate measure of information sent/received when types and actions are uni-dimensional and the receiver wants to match the action to the type, but not in our setting with two-dimensional types and binary actions.

Our first two hypotheses consider our first research question regarding the effect of evidence. In the GR equilibrium of RV the receiver does better than in the pooling equilibria of BASE. Thus, Hypothesis 1 is that evidence helps the receiver when the receiver controls the verification process:

Hypothesis 1: The receiver payoff is higher in RV9 than BASE9, and higher in RV11 than BASE11.

Hypothesis 2 concerns the effect of evidence when the sender controls the verification process. Again, the GR equilibria result in a higher payoff than in the pooling equilibrium of BASE, and thus we hypothesize that evidence is beneficial to the receiver in SR, just as in RV:

Hypothesis 2: The receiver payoff is higher in SR9 than BASE9, and higher in SR11 than BASE11.

This leads us to our second research question. If evidence helps, does it matter which player controls the verification process? The receiver's expected payoff is the same in GR equilibria of RV and SR and so our hypothesis states that there is no difference in average payoffs due to verification control:

Hypothesis 3: Receiver payoffs are the same in RV and SR for both T11 and T9.

Of course, it is an empirical question whether subjects' behavior will be consistent with these implications of GR equilibria. First, there are many other equilibria, and no clear consensus on how to select among them. Second, even focusing on GR equilibria there is multiplicity and expecting that a pair of players will magically agree on some GR equilibrium may seem unrealistic. Third, as in other communication game experiments, it seems possible that outcomes that are inconsistent with any equilibrium may be observed. We note that although GR equilibria imply Hypothesis 1, this hypothesis follows more generally because the receiver's expected payoff is higher in any equilibrium of RV than in the pooling equilibrium of BASE. For Hypothesis 2 the GR selection is crucial because there are equilibria of SR9 and SR11 that result in the same outcome as those of BASE9 and BASE11 respectively. Nevertheless, there are GR equilibria with the intuitive property that the sender reveals their best evidence and the receiver accepts if this evidence is sufficiently strong, and in these equilibria Hypothesis 2 follows. Hypothesis 3 is perhaps the most empirically challenging implication of GR equilibria. The next section describes our experiment, designed to test these hypotheses.

4 EXPERIMENTAL DESIGN

The experiment was conducted in the CeDEx laboratory at the University of Nottingham, UK. There were 540 subjects, recruited from a university-wide pool of undergraduate and graduate students using ORSEE (Greiner, 2015). The experiment was programmed in z-Tree (Fischbacher, 2007).

Our experiment varies six treatments across sessions, where a treatment uses one of the games (either BASE, SR or RV) and parameterizations (T9 or T11). We planned for 4 sessions of each treatment with 24 subjects per session, with subjects being divided into two matching groups so that we have 8 independent observations per treatment. Due to no-shows we had only 20 subjects in six of the T9 sessions (one RV9, two SR9 and three BASE9). Thus, in these sessions the matching group is based on 10 rather than 12 individuals.

Upon arrival at a session, subjects were randomly allocated a seat number and given a set of instructions, which were then read aloud by the experimenter.[8] The decision-making part of the experiment then consisted of 30 periods, where subjects were randomly matched in each period to play the relevant game. Subjects were rematched within their matching group at the beginning of each period, but retained the same role (sender or receiver) during the entire session.

At the beginning of each period, each sender is dealt two cards (blue and orange). These two cards represent the two aspects determining the sender's type. Each of the cards is equally likely to be any integer value between 1 and 9, and all draws are independent across colors and senders.[9] A sender's type is called "a hand" and is defined as "good" if the sum of the two cards is at least 9 in the T9 treatments or at least 11 in the T11 treatments. Having observed the two cards, the sender sends a message to the receiver of the form "The value of the orange card is __; The value of the blue card is __". In RV, the receiver then chooses one of the cards to observe, while in SR the sender then chooses one of the cards for the receiver to observe. Next, in all treatments, the receiver chooses to accept or reject. The sender

[8]See Online Appendix OA.A for a copy of the instructions.

[9]For the RV treatment the card draws were randomized using the random number generator during the session. To enhance comparability across treatments, we then used these realizations in the corresponding sessions of the BASE and SR treatments. This allows us to perform the statistical comparisons on paired observations. For comparisons involving matching groups with 10 subjects, we dropped the equivalent observations from the other treatments so that the comparison used the same set of realised draws.

earns 1 point if the receiver accepts and 0 if the receiver rejects; the receiver earns 1 point if she accepts a good hand or rejects a bad hand, and 0 otherwise. At the end of each period, a summary screen displays the true values of the two cards, the message sent by the sender, the receiver's decision, and the point-earnings of the two subjects. In SR and RV the summary screen also shows the card chosen to be observed (by the receiver or by the sender, depending on treatment).

At the end of the experiment subjects received their accumulated earnings for the 30 periods (1 point = £0.50) plus a £3 participation fee. Each session lasted around 90 minutes, and average earnings were £12.92 for the T11 treatments and £14.12 for the T9 treatments.

5 RESULTS

We report our results in three subsections. First, we answer our research questions regarding the effect of evidence and verification control by focusing on final outcomes for the receiver in our experiment. Second, we analyze players' behavior in detail to better understand the mechanisms driving these results. Finally, to identify whether and how the receivers could have done better in our games, we analyse receiver optimal strategies given the observed sender behavior.

Unless otherwise specified, all statistical tests are two-tailed signed-rank tests using a 5% significance level and taking the pooled data from a matching group as the unit of observation. We use the signed-rank test because each matching group in a treatment can be paired with a corresponding observation in another treatment with identical sender type realizations.[10] We take the matching group as the unit of observation for our non-parametric tests because repeated interaction is likely to result in dependencies between choices within the matching group. We also examined whether there were any dynamic trends in behavior and how these might affect our results. We find some evidence of mild learning effects, but the

[10] In every T11 matching group, 6 senders and 6 receivers each play 30 games, resulting in a total of 180 games. As noted in the previous section, due to no-shows, six sessions of T9 had 5 senders and 5 receivers, resulting in 150 games instead of 180. There were more such sessions in BASE9 than RV9 or SR9. So, for comparability reasons, we exclude the corresponding (same sender type realizations) missing observations from RV9 and SR9. Overall, our analysis is based on 1440 games in each T11 treatment and 1260 games in each T9 treatment.

results based on the pooled data are robust to these - see Online Appendix OA.B for details.

5.1 *Outcomes and payoffs*

Recall our first research question: *do receivers benefit from evidence?* Figure 1 presents the average payoff comparisons for receivers across treatments. Confirming Hypotheses 1 and 2, receivers are significantly better off with evidence than without, for both T9 and T11.

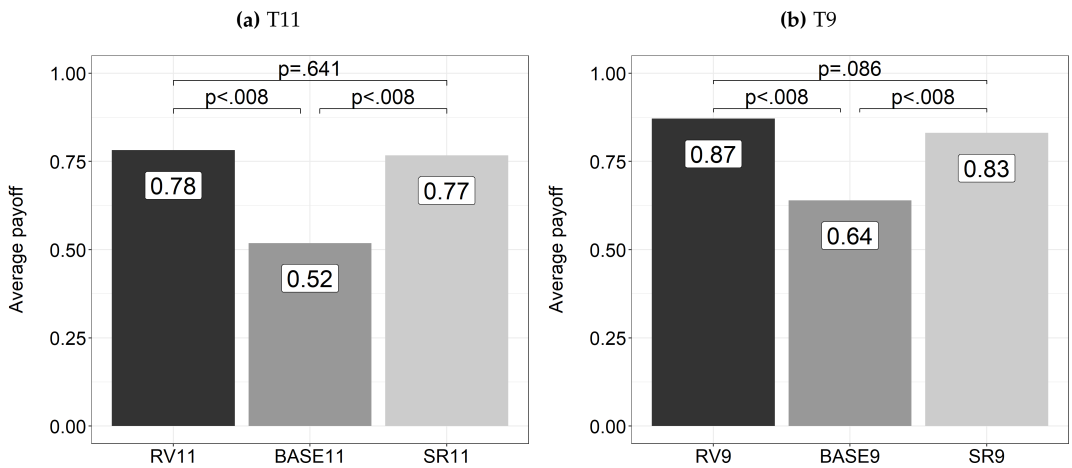


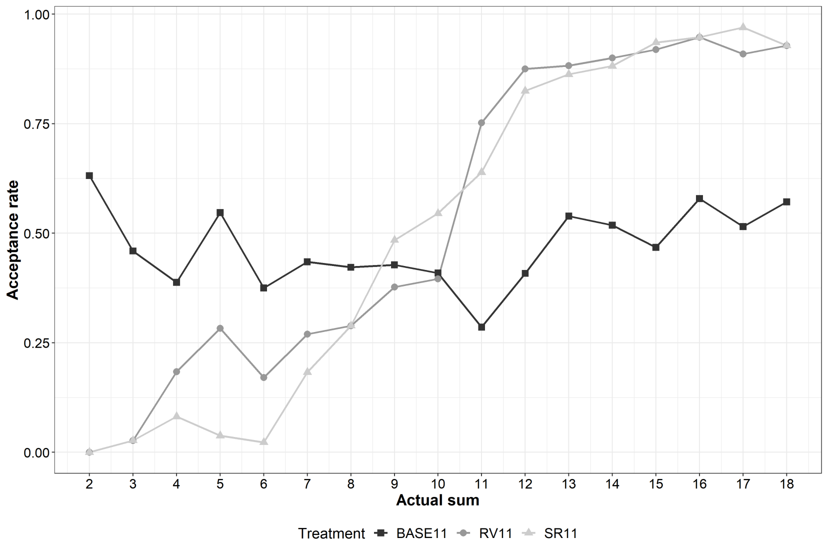
Figure 1: Receiver's average payoff across treatments

Result 1 *The receiver benefits from evidence in both RV and SR, for both T9 and T11.*

Figure 2 shows the distribution of acceptance rates as a function of the sum of the two aspects to further illustrate the benefits of evidence for the receiver. While acceptance rates are relatively flat in both BASE treatments, they follow a strong upward trend in all evidence treatments. This shows that the receiver is better able to identify good and bad hands in the evidence treatments.

To quantify the effect of evidence, in Table 3 we compare the receiver's payoff in the experiment (column 1) with what they would get in different information transmission benchmarks. One benchmark is where no information is transmitted and receivers optimally respond to their prior (column 2). Without evidence, receivers' average payoff is very close to, in fact a little lower than, their expected payoff in

(a) T=11



(b) T=9

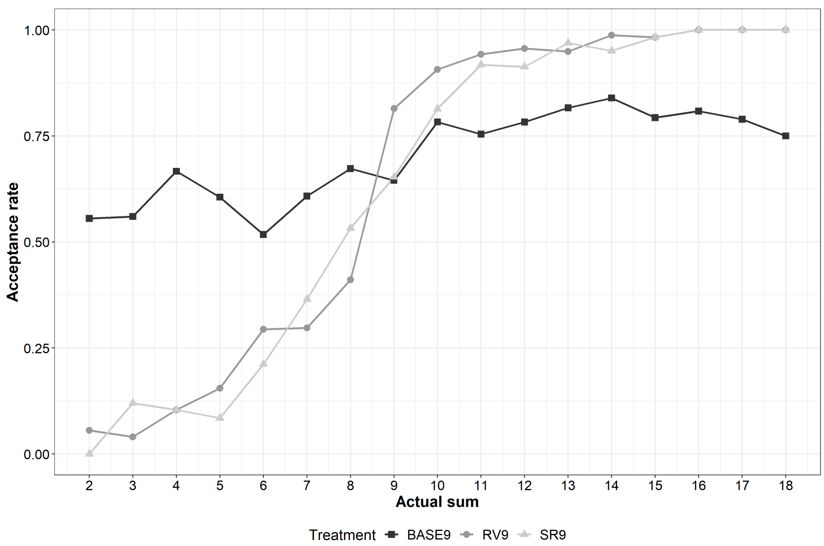


Figure 2: Acceptance rate against actual sum

Table 3: Receiver's average payoff in different information transmission benchmarks

Treatment	(1) Observed in experiment	(2) No-info (prior)	(3) Max-info eq.	(4) Best response
BASE11	0.52	0.56	0.56	0.63
RV11	0.78	0.56	0.81	0.85
SR11	0.77	0.56	0.81	0.83
BASE9	0.64	0.66	0.66	0.72
RV9	0.87	0.66	0.89	0.88
SR9	0.83	0.66	0.89	0.89

the no-information benchmark (BASE11: $p = 0.039$; BASE9: $p = 0.398$). When evidence is present, however, receivers are always doing better than the no-information benchmark (RV11: $p = 0.008$; SR11: $p = 0.008$; RV9: $p = 0.008$; SR9: $p = 0.008$).

Another benchmark is the equilibrium with maximum information transmission (column 3). For BASE, this is the same as the no-information benchmark. For SR and RV, the maximum information benchmark is given by the receiver's payoff in the GR outcome. We find that receivers in SR are doing significantly worse than the optimal benchmark for both T11 and T9, while in RV there is no significant difference (SR11: $p = 0.008$; RV11: $p = 0.187$; SR9: $p = 0.008$; RV9: $p = 0.172$).

For completeness we also analyze the effect of evidence on senders' average payoffs. Recall that in BASE11, the equilibrium predicts that senders' average payoff is 0 (receivers always reject), while in BASE9 it is 1 (receivers always accept). We find large deviations from these predictions, with senders obtaining an average payoff of 0.44 in BASE11 and 0.71 in BASE9. More importantly though, senders are helped by evidence in T11 (BASE11 vs. RV11 (0.54), $p = 0.008$, vs SR11 (0.52), $p = 0.008$) and hurt, but not significantly, in T9 (BASE9 vs. RV9 (0.70), $p = 0.711$, vs. SR9 (0.68), $p = 0.109$).

We now turn to our second research question: *do receivers benefit from controlling the verification decision?* Although receivers do slightly better in RV than in SR, we cannot reject Hypothesis 3 that receivers' average payoffs are the same across treatments (see Figure 1).

Result 2 *Receivers' average payoffs do not differ significantly between SR and RV.*

The same holds for senders: their average payoffs do not differ significantly across treatments (RV11 vs. SR11: $p = 0.468$; RV9 vs. SR9: $p = 0.266$). In the next section we investigate these results in more depth by analyzing players' behavior.

5.2 *Behavior analysis*

5.2.1 *Explaining the effect of evidence*

To understand how evidence leads to higher receiver payoffs, we begin by differentiating between information sent and information received, similarly to Fréchette et al. (2022). To measure information sent, we use the receiver's expected payoffs from best responding to the signals sent since best responding implies taking advantage of all the available information (column 4 in Table 3).[11] First, we find that in all treatments, the best response payoff is higher than the no-information one (BASE11: $p = 0.008$; RV11: $p = 0.008$; SR11: $p = 0.008$; BASE9: $p = 0.016$; RV9: $p = 0.008$; SR9: $p = 0.008$). Second, evidence leads to a significantly higher amount of information being sent (RV11 vs BASE11: $p = 0.008$, SR11 vs BASE11: $p = 0.008$; RV9 vs BASE9: $p = 0.008$, SR9 vs BASE9: $p = 0.008$).

Result 3 *Evidence leads to a higher amount of information being sent compared to BASE, for both SR and RV and for both T11 and T9.*

For this additional information to help receivers in RV and SR, they need to take advantage of it. To answer the question of whether the information sent by senders is also received, we compare receivers' actual payoffs (column 1, Table 3) with their best response payoffs. We find that, except in the RV9 treatment, receivers are never taking advantage of all the available information since their observed payoffs are significantly lower than what they could get if they were best responding (BASE11: $p = 0.008$; RV11: $p = 0.008$; SR11: $p = 0.008$; BASE9: $p = 0.008$; RV9: $p = 0.711$; SR9: $p = 0.008$). However, as discussed earlier in connection to Result 1, receivers are always doing significantly better than the no-information benchmark when evidence is present, but not when it is absent. This suggests that, although information is sent in all treatments (as shown above, a significant amount of information is sent even in BASE), it is only meaningfully used in RV and SR. Indeed, when we compute how often receivers' decision matches the one predicted by the best response strategy, we find that in BASE11, this happens only 56% of the time, a frequency significantly lower than the 81% in RV11 ($p = 0.008$) and the 83% in SR11 ($p = 0.008$). Similarly, in BASE9 receivers' decision is the same as the best response prediction in 73% of the cases, a frequency significantly lower than the 93% in RV9 ($p = 0.008$) and the 87% in SR9 ($p = 0.008$).

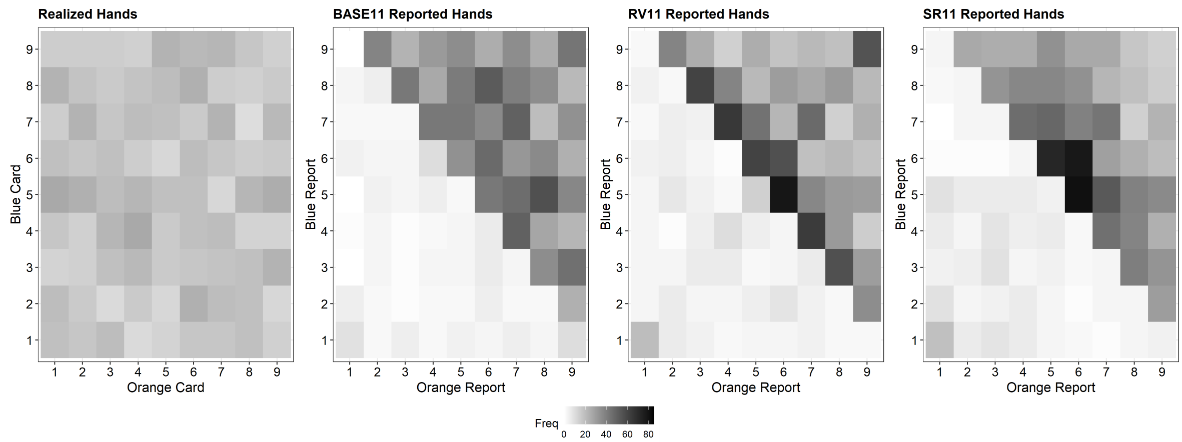
Result 4 *Receivers do not always take full advantage of the information sent. However, receivers use more of the information sent when evidence is present, than when it is absent.*

One possible channel through which evidence could have led to an increase in information transmission is an increase in the amount of truthful messages. Figure

[11] Details about the calculation of the receiver's best response payoff are presented in Section 5.3.

3 presents the distribution of realized and reported hands across treatments. Recall that the random draws are identical across treatments for both T9 and T11, as each combination of values was equally likely, the distribution of the realized hands is approximately uniform. We notice a clear difference between the distribution of reported and realized hands in all treatments. In particular, there is a shift in the distribution of reported values towards the area where these add up to at least T.

(a) T11



(b) T9

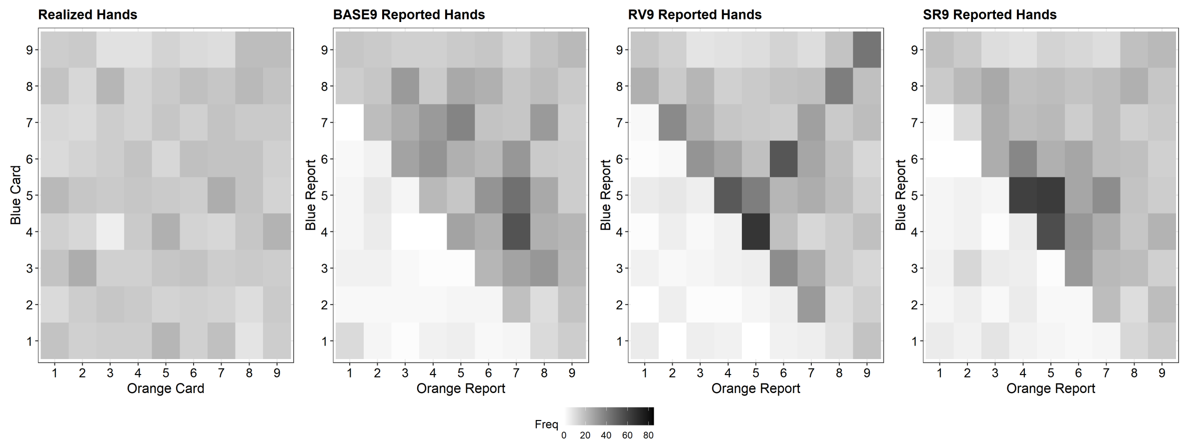


Figure 3: Distribution of realized vs. reported hands

Table 4 reports the truth-telling rate across treatments. While most hands (good or bad) are reported as good, evidence seems to slightly increase the truth-telling rates irrespective of the value of T. However, differences are significant only in the cases of good hands in BASE11 vs RV11, $p = 0.016$, and good hands in BASE9 vs SR9, $p = 0.047$. [12]

[12]Interestingly, very few subjects can be characterized as truth-tellers (never misreporting). We observed only 3 truth-tellers in the RV9 and SR9 treatments, 2 in BASE11 and RV11 and 1 in BASE9 and SR11. Even if we consider the rate of truthful reporting of bad hands (up to 20%)

Table 4: Truth-telling rates

		Truth-telling rate				Truth-telling rate		
Hand	obs.	BASE11	RV11	SR11	obs.	BASE9	RV9	SR9
Good	631	0.811	0.918	0.848	832	0.779	0.888	0.870
Bad	809	0.120	0.193	0.199	428	0.161	0.187	0.231

Result 5 *Senders typically report bad hands as good and this happens with similar frequencies across all treatments.*

This suggests that evidence does not systematically increase the amount of information by increasing the truthfulness of messages. However, what is clear in Figure 3 is that the distribution of reports is affected by evidence. In particular, we observe a higher concentration of reports that add up to T in the evidence treatments compared to the BASE ones. It turns out that in cases where there is a clear incentive to misreport because the hand is bad, senders inflate their reports to "the bare minimum" (the respective value of T), significantly less often in BASE11 (22%) compared to RV11 (42%, $p = 0.008$) and SR11 (35%, $p = 0.016$), as well as in BASE9 (16%) compared to RV9 (42%, $p = 0.008$) and SR9 (35%, $p = 0.016$).

Result 6 *Senders are more likely to inflate bad hands to a value equal to T when messages are partially verifiable than when they are not.*

One explanation for this finding relates to the additional constraint that evidence puts on messages. In particular, senders face a need to inflate bad hands while keeping the higher report truthful when verification is possible as in SR and RV, but not in BASE. To illustrate, consider a sender in SR11 planning to reveal their highest card which is a 6. Reporting a number higher than 6 on the unobserved card would seem suspicious. So, their only options for reporting a good hand are (6,5) or (6,6), while in BASE11 they could report anything. Hence, even though they could say (6,6) in SR11 – they are not forced to say (6,5) - their options are much more limited than in BASE11. A similar argument applies in RV if higher reported values are more likely to be checked (this is indeed the case as we will see). Indeed,

as an estimate for truth-telling, this is still rather low. Thus, our setting does not induce a very strong norm of honesty (cf. Abeler et al. (2019)). This could be due to the conflict of interests which may crowd out lying aversion (Cabrales et al., 2020; Minozzi and Woon, 2013), or it could reflect a different norm induced by the framing of our game. Nevertheless, the low truth-telling rate seems to be in line with other studies using cheap-talk games (e.g. (Minozzi and Woon, 2013; Sánchez-Pagés and Vorsatz, 2007)).

a sender whose highest card is a 6 would need to report the other card as 5, since (6,6) would result in the misreport being discovered half of the time.

Overall, these results suggest that the availability of evidence does not have a strong impact on the likelihood of truthful reporting, though it does affect the distribution of reports, forcing senders to misreport in more predictable ways. This could be part of the reason why evidence helps receivers, provided receivers are more likely to reject false claims that add up to T. As we show later on when analyzing in more detail the acceptance decision, receivers are generally more likely to reject claims equal to T, but only in SR, suggesting this is not the main driver of the effect of evidence. Instead, and perhaps unsurprisingly, the main benefit of the evidence treatments to the receiver comes from the evidence itself. In SR, senders nearly always reveal the higher card and these observed values are informative about the state. In RV, the availability of evidence also helps receivers uncover misreports. We discuss sender and receiver strategies in more detail next.

5.2.2 *Exploring the (lack of an) effect of verification control*

Due to the more complex nature of the data in the evidence treatments, and the fact that all our results pertaining to the comparison between RV and SR are similar for both values of T, in this section we focus on the T11 treatments and present a summary of the corresponding results for T9 in Appendix F. In the previous section we showed that neither the receiver, nor the sender benefits from verification control. We now look at potential differences in behavior.

Messages

We have already established that the overall truth-telling rates do not differ across treatments. In Table 5 we present the truth-telling rates across treatments depending on whether senders have a good or a bad hand and whether a high card (7+) is present. When senders have a good hand they tend to report it truthfully, although slightly and significantly more often in RV11. When senders have a bad hand, the value of the evidence does not matter in RV11. This is not the case in SR11 where less than 8% of senders with a 7+ card tell the truth compared with more than 24% of senders without a 7+ card ($p - value = 0.008$). This suggests that truth-telling is less helpful for the receiver in SR11, since it is more concentrated in cases where the receiver may have inferred a bad hand purely from the evidence.

Table 5: Truth-telling rates for good and bad hands conditional on the value of the highest card

Type of hand		obs.	Truth-telling rate SR11	RV11	$p - value$
Good hands	High card < 7	51	0.863	0.941	0.313
	High card ≥ 7	580	0.847	0.916	0.016
	All good hands	631	0.848	0.918	0.016
Bad hands	High card < 7	591	0.245	0.201	0.461
	High card ≥ 7	218	0.073	0.170	0.188
	All bad hands	809	0.199	0.193	0.813
All hands		1440	0.483	0.510	0.461

Table 6 focuses on the reporting behavior of senders with bad hands and a 7+ card. Recall that there are equilibria resulting in the GR outcome (i.e., only hands with a 7+ card are accepted) where these senders report a good hand by inflating the value of the lower card while keeping the higher claim truthful. Table 6 shows that most reports are consistent with these equilibria in both treatments, but this behavior is more prevalent in SR11 than RV11 (79% vs 61%, $p - value = 0.031$).

Table 6: Proportions of different types of reports (bad hands with a 7+ card)

	SR	RV
Good hand reported; higher claim is truthful	0.789	0.606
Good hand reported; lower claim is truthful	0.018	0.069
Good hand reported; one out of two equal claims is truthful	0.092	0.078
Good hand reported; neither claim is truthful	0.005	0.055
Bad hand reported	0.096	0.193

Result 7 *Senders with a bad hand and a 7+ card usually inflate the value of the lower card while keeping the higher claim truthful, but significantly more often in SR11 than in RV11.*

Result 7 suggests that senders with a bad hand and a 7+ card may fare better in SR11 than in RV11, while receivers may fare worse for these types. This would happen if senders reveal and receivers verify the higher claim and if receivers reject when the sender claims to have a bad hand or when the value observed is misreported or below 7. We explore which evidence is observed and receivers' acceptance decision next.

Revelation/verification

When the sender reports a bad hand, the verification strategy is immaterial since the sender is almost certainly telling the truth (indeed, more than 98% of all reported bad hands are true bad hands in both treatments). In what follows we focus on cases where the sender reports a good hand. We also focus on cases where, for RV11, the two reported values are different and, for SR11, the two card values are different. In SR11, senders nearly always reveal the higher of the two cards: 96.23% of cases. In RV11, receivers check the higher of the two reports only in 64.86% of the cases ($p - value = 0.008$). Thus, it appears that revealing the higher card is a more compelling strategy for senders than verifying the higher claim is for receivers.

It is informative to look at this behavior at the individual level as well. Figure 4 shows the individual propensity to reveal the higher card (SR11) or check the higher claim (RV11). Not surprisingly given the high aggregate frequency of revealing the higher of the two cards, in SR11 60% of senders always reveal the higher card. In contrast, none of the receivers in RV11 checks the higher claim all the time, though most receivers check it more often than not.

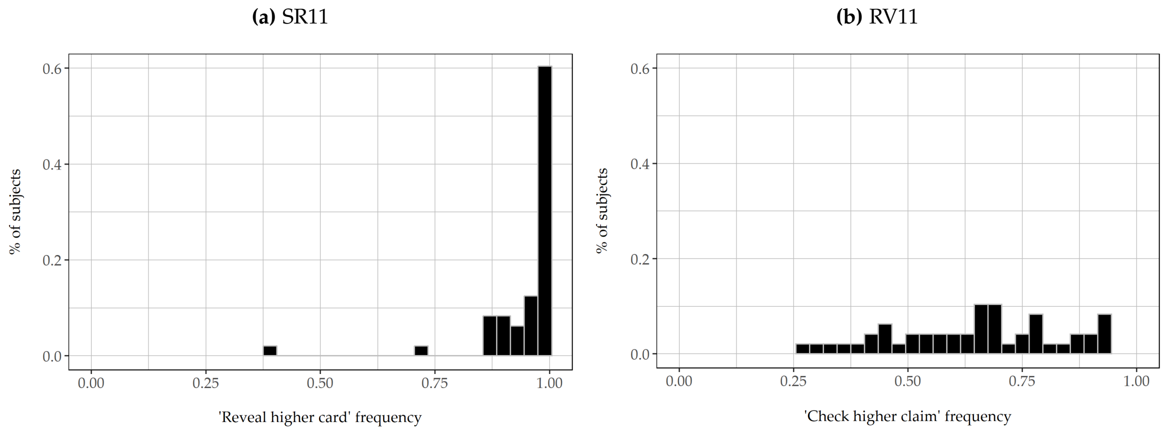


Figure 4: Individual propensity to reveal the higher card (SR) or check the higher claim (RV)

Result 8 *Senders reveal the higher card significantly more often than receivers check the higher claim.*

An implication of this different revelation/verification behavior is that the sender's high card is almost always observed in SR11, while in RV11 the sender's high card is observed less frequently. Another implication of this behavior is that the frequency of observing a 7+ card when the sender has one differs across treatments. In the GR equilibria, this frequency would be 100% in both SR11 and RV11. We find that such values are observed in 66% of cases in RV11, whereas in SR11, this happens significantly more often, in 97% of the cases ($p - value = 0.008$).

Result 9 *The frequency of observing a 7+ card is significantly higher in SR11 than RV11.*

Thus, there seems to be a clear difference in verification/revelation behavior. In SR11, senders may view their task as persuading the receiver about their hand being good, in which case showing their strongest evidence seems compelling. In RV11, receivers seem to be using a less predictable random auditing strategy with the goal of catching liars.

Acceptance

When the sender reports a bad hand, the receiver nearly always rejects (over 96% of cases in both treatments). In what follows, we focus on cases where a good hand is reported. One important factor that influences the receiver's decision is the value of the *observed card*. The upper panel of Figure 5 presents the acceptance rate conditional on the value observed by the receiver. Acceptance rates increase with the observed value and are generally higher in RV11 than SR11, significantly so for observed values between 3 and 7 ($p - value < 0.047$ for each case).

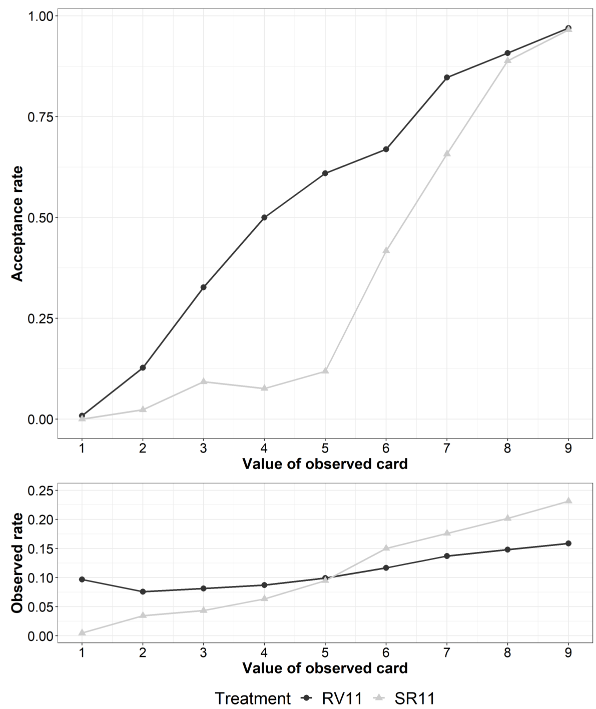


Figure 5: Acceptance rates conditional on the value of the observed card and corresponding relative frequencies of each observed value (reported good hands only; 1245 observations for SR11, 1242 observations for RV11)

Result 10 *Conditional on the observed value, the acceptance rate is higher in RV11 than SR11. This difference is significant for observed values between 3 and 7.*

The lower panel in Figure 5 depicts the relative frequency of each value observed by receivers. Even though the same random draws are used for both treatments, differences in the distributions of observed values arise from different behavior across treatments. Specifically, the observed card in SR11 is almost certain to be the highest of the two, while this is not the case in RV11. Consequently, the distribution of observed cards in SR11 is very similar to the distribution of the maximum value of the two cards, while the distribution in RV11 is comparatively flat.

An implication of this finding is that, for a given value of the observed card, the hand is more likely to be good in RV11 than in SR11, hence the higher propensity to accept in RV11 may be justified (we will return to this point when we discuss Figure 6 below). Recall also that overall acceptance rates conditional on the sender claiming to have a good hand are very similar (60% in SR11 and 62% in RV11). The reason for this is that, while the receiver is more likely to accept for a fixed value of the observed card in RV11, she is also more likely to observe lower cards in RV11 (and lower cards are less likely to be accepted).

Another factor that influences receivers' decisions is how the observed card compares with the message. In SR11, senders hardly ever misreport the card they reveal (less than 4% of the time), but in RV11 a misreport is observed in 30% of cases. Receivers typically reject when observing a misreport (93% of the time in SR11 and 95% in RV11). Rejecting after observing a misreport is optimal for the receiver since only about 10% of such hands are good hands. Figure 6a shows the acceptance rates conditional on the value of the observed card given that no misreport is observed.

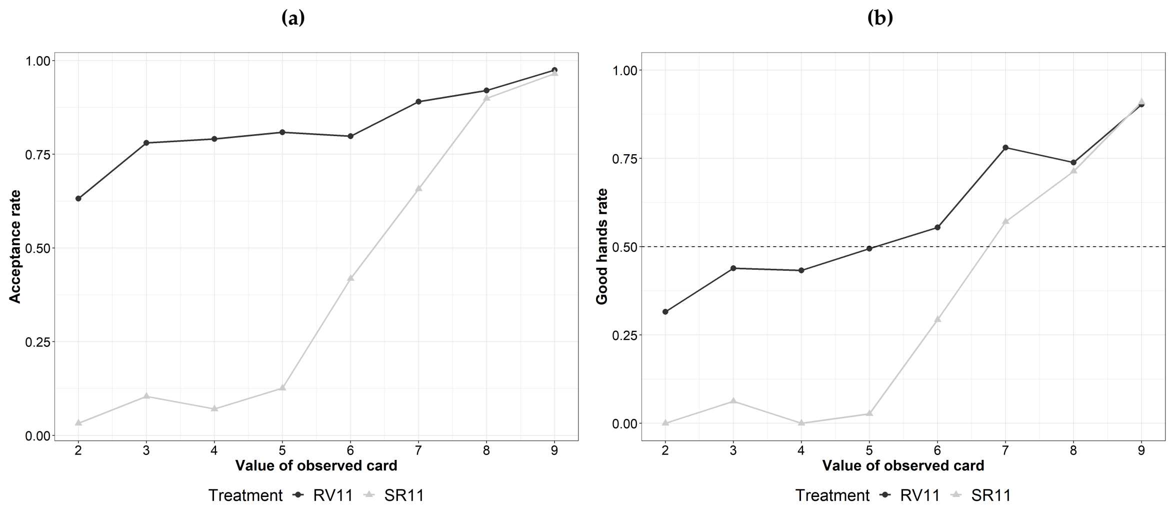


Figure 6: Acceptance rates (a) and proportion of good hands (b) given that a good hand was claimed and no misreport was observed (1199 observations for SR11, 862 observations for RV11)

As the figure shows, the receiver is very likely to accept in RV11 if no misreport is observed. This behavior is not as costly as one may think since a) some bad hands have been weeded out when a misreport is discovered (the sender's messaging behavior facilitates this) and b) the receiver's verification strategy implies that the card observed is not always the higher of the two. This is confirmed in Figure 6b which shows the proportion of good hands when a good hand is reported and no misreport is observed. The figure includes a dotted line at 50% - above this line, it is optimal to accept, while below this line it is optimal to reject.[13]

In SR11, receivers are clearly better off rejecting values of 6 and less, and this is what they usually do, though for the value of 6 they accept more than 40% of the time. For values of 8 or 9, they are clearly better off accepting and this is what they almost always do. When a 7 is observed, accepting would give a slightly higher average payoff than rejecting, and receivers do so about two thirds of the time. In RV11, the probability of a good hand remains close to 0.5 even for values as low as 3, and so even though the receiver is too lenient for low observed values, the cost of an acceptance decision is small in terms of payoffs.

To further investigate factors influencing receivers' acceptance decisions we conduct a probit analysis (Table 7). We include as explanatory variables the value of the observed card, the value of the unverified claim, and a dummy for whether a misreport is observed. We also include four control variables: a color dummy to test whether receivers condition on the color of the observed card; a dummy for whether the claimed sum is equal to 11 (the good hand threshold) - this is motivated by the observation that senders tend to inflate claims "up to the bare minimum" and we want to check how the receivers use this information in their acceptance decision; a good hand dummy to check whether there is any other information apart from the included variables that may help (if they are more likely to accept a good hand) or harm (if they are less likely to accept a good hand) receivers; a gender dummy. Period and group fixed effects are also controlled for.

We notice that the value of the observed card has a significantly positive effect on the acceptance probability, but the effect in SR11 is more than twice that in RV11. In addition, the value of the unverified claim has a significant though small

[13]Optimality here refers to strategies that do not condition on other features of the message. In principle, if the message is informative (for example, by always inflating bad hands up to the bare minimum) it would be possible for the receiver to use the message to improve the accuracy of the acceptance decision. Below, we check whether there is any evidence receivers are able to distinguish between good and bad hands.

Table 7: Probit analysis of acceptance decision

	Dependent variable:	
	Acceptance Decision	
	(RV11)	(SR11)
Value of observed card	0.106***	0.235***
	(0.034)	(0.020)
Value of unverified claim	0.057**	0.010
	(0.028)	(0.011)
Misreport observed	−0.803***	−0.367*
	(0.025)	(0.205)
Observed card = orange	0.046	0.014
	(0.054)	(0.043)
Hand = good	0.026	0.080*
	(0.048)	(0.047)
Claimed sum = 11	0.013	−0.130***
	(0.104)	(0.047)
Female	0.002	−0.065
	(0.043)	(0.064)
Period FE	Yes	Yes
Group FE	Yes	Yes
Observations	1,242	1,245

Notes: The table presents marginal effects. Period and group fixed effects are not reported. Standard errors in parentheses are robust and clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01. The analysis excludes cases where the sum of the two reports was less than 11 (claimed bad hands).

positive effect on the acceptance probability only in the RV11 treatment. Observing a misreport substantially reduces the receiver's acceptance probability in RV11; the estimated effect in SR11 is smaller and only marginally significant. In terms of the control variables, the regressions give no evidence of a color bias or gender effect. However, we find that in SR11 receivers are less likely to accept when the claimed sum is equal to 11, whereas in RV11 this variable is not significant. Finally, in RV11 it appears that after controlling for other variables, bad hands are as likely to be accepted as good hands. In SR11, receivers are slightly more likely to accept good hands; however, this effect is small and only marginally significant.

Result 11 *The acceptance decision in RV11 is driven mainly by whether a misreport is observed, while in SR11 by whether the observed card has a sufficiently high value.*

The differences in verification and acceptance strategies suggest that the GR outcome may be more likely in SR11 than in RV11. We can check this by looking at the acceptance rates across treatments conditional on the value of the higher card, plotted in Figure 7. To better understand the effect this has on players' payoffs we differentiate between good and bad hands. The figure also plots the GR outcome prediction (dashed lines), where a hand is accepted if and only if it contains a 7+ card. In SR11, hands with a 7+ card are usually accepted, and hands without one are usually rejected, making the outcome of most hands in SR11 consistent with the GR outcome. In RV11, however, outcomes conform less well with the GR outcome.

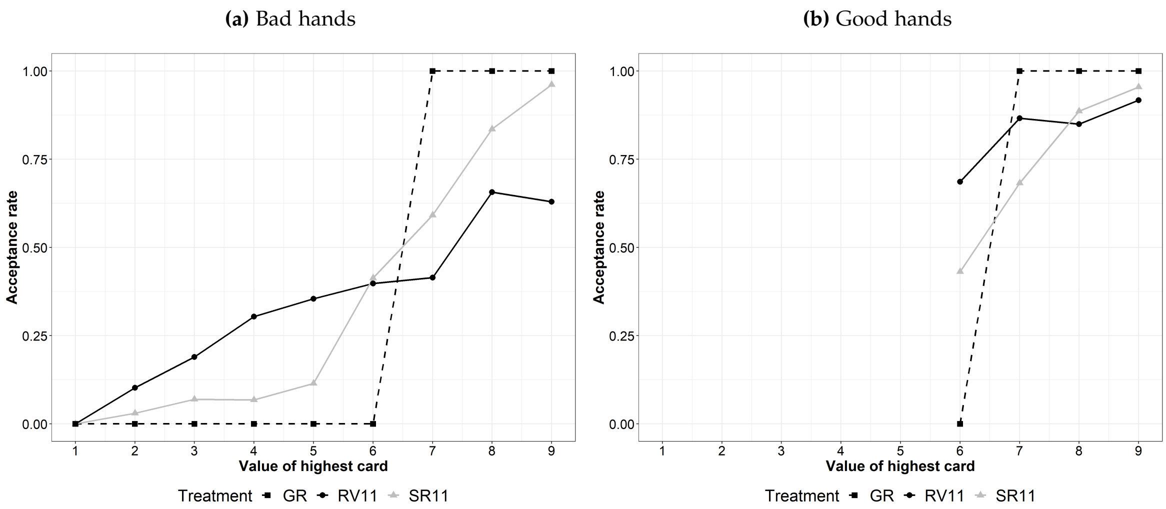


Figure 7: Acceptance rates for a given value of the highest card

Table 8 summarizes the information in Figure 7, by presenting the acceptance rates, conditioning only on whether the hand is good or bad and on whether the hand is accepted (highest card ≥ 7) or rejected (highest card < 7) in the GR outcome. This allows us to understand whether any differences between SR and RV are beneficial to the receiver.

Table 8: Acceptance rates for good and bad hands conditional on the value of the highest card

Type of hand		obs.	Acceptance rate		
			SR11	RV11	$p-$ *value*
Highest card < 7	Bad hands	591	0.139	0.228	0.039
	Good Hands	51	0.431	0.686	0.016
	All hands	642	0.162	0.265	0.008
Highest card ≥ 7	Bad Hands	218	0.679	0.440	0.039
	Good hands	580	0.869	0.884	0.469
	All hands	798	0.817	0.763	0.461

The deviations from the GR outcome in RV are not always detrimental to receivers. Receivers are benefiting from verification control in the case of good hands without a 7+ card, which are accepted significantly more often in RV11 than SR11, despite the fact that the GR outcome predicts these should be rejected. Similarly, receivers are benefiting by rejecting more bad hands with a 7+ card in RV11. However, receivers are doing worse in RV11 for bad hands without a 7+ card. From the figure it is also clear that because of these differences in acceptance rates, some types of senders get a higher payoff in SR11 than in RV11 (e.g. senders with a bad hand and a 7+ card), while other types prefer RV11 to SR11 (e.g. senders with a bad hand and no 7+ card).

Overall, we find that hands that are rejected in the GR outcome (highest card < 7) are more likely to be accepted in RV11 than SR11. Bad hands that are accepted in the GR outcome (highest card ≥ 7) are more likely to be accepted in SR11 than RV11. This leads to the GR outcome correctly predicting 82.64% of acceptance decisions in SR11, which is significantly more than the 75.07% correct predictions in RV11 ($p - value = 0.008$).

Result 12 *The proportion of GR outcomes is higher in SR11 than in RV11.*

We have established significant differences in the messaging strategy (in a direction that potentially helps receivers in RV11, see Result 7), the verification strategy (senders almost always reveal the higher card but receivers do not always check the higher claim, see Result 8) and the acceptance strategy (in SR11, the acceptance decision is mainly based on whether the observed value is high enough though receivers penalize reports that add up to exactly 11; in RV11, the acceptance decision is mainly based on whether a good hand is reported and no misreport is observed, see Result 11). These differences translate into differences on how well the outcomes conform to the GR predictions, and how well specific sender types expect to fare. However, they do not translate into differences in overall payoffs, as receiver gains for good hands in RV11 are offset by losses for bad hands.

5.3 *Best-response analysis*

Given that the sender always wants the receiver to accept, how should the receiver respond to different messages and evidence? We answer this by identifying the optimal strategy for the receiver given the observed sender's behavior. We begin with both BASE games across which the receiver's best response is notably different and continue with the evidence treatments. For the latter, we only present the best response details for T11 as the characteristics of these are similar to those of T9 (see Appendix F).

5.3.1 *Baseline*

In the BASE games, the receiver has only an acceptance decision to make. The information available to her when making this decision consists of the sender's message. From analyzing the frequency of good hands for each message combination (see Tables G1 and G2 in Appendix G), we notice that in several instances, the receiver would be better off deviating from the prior-optimal decision (to reject in T11 and accept in T9). In T11, this is typically the case when the sender claims to have a good hand containing a 9, while in T9, when the sender reports having a bad hand.

5.3.2 *Sender-Reveals*

In the SR11 game, like in BASE11, the receiver has only an acceptance decision to make. However, the information available to the receiver is now richer, consisting of the revealed value and the sender's message. We refer to the strategy of making the optimal decision for each combination of revealed value and unverified claim as the empirical best response (described in detail in Appendix G). The resulting expected payoff is 0.827, and we refer to this as the empirical optimum.

Next, we evaluate the performance of some alternative strategies. Table G4 in Appendix G presents the alternatives. We categorize these based on the amount of information used to inform the receiver's strategy. For the strategies in which the receiver uses a threshold acceptance rule, conditioning on the value of the observed card, we present the threshold that gives rise to the highest payoff and the two closest thresholds. First, note that if the receiver ignores messages and evidence, the best she can do is to always reject since the prior probability of a good hand is below 50%. The receiver can do substantially better by using evidence to inform the acceptance decision; the optimal threshold rule is to accept if the revealed card is 7+. This is an optimal commitment strategy and would result in the GR outcome if the sender best responds to it. The receiver can do slightly better by considering both the message and the evidence; the highest payoff in this class of strategies is achieved by accepting when a 7+ is revealed and the hand is claimed to be good. This is also an optimal commitment strategy. If the sender best responds to the receiver, these optimal commitment strategies do equally well. However, because some senders own up to having a bad hand, the strategy that considers both messages and evidence does slightly better. In fact, the strategy of accepting if and only if a good hand is claimed and a 7+ is revealed prescribes very similar decisions to those of the empirical best response, and as a result achieves a very similar payoff.

Result 13 *Given the sender's observed behavior in SR11, following the optimal commitment strategy of accepting if and only if a good hand is claimed and a 7+ card is revealed gives the receiver 99.40% of the empirical optimum.*

5.3.3 *Receiver-Verifies*

For RV11, the receiver must decide which card to verify and whether to accept or reject. In determining the best response, we allow the verification strategy to depend on the message, and the acceptance decision to depend on the message and on whether the verified card was equal to the claim or misreported (the strategy is described in Appendix G). The receiver's expected payoff from best responding to each message is 0.853. How does this payoff compare to what the receiver could get from other possible strategies? Table G6 in Appendix G presents some alternatives. Again, we categorize these based on the amount of information used to inform the receiver's strategy.[14]

We start by recalling that there are more bad hands than good hands, hence the receiver can obtain more than 50% by rejecting, regardless of messages or evidence. By checking at random and accepting if the observed card is high enough, the receiver does even better. The optimal threshold is to accept if the observed card is 6+ (leading to a payoff of 0.752). The receiver does even better using the "fair random" strategy of checking at random and accepting if a good hand is claimed and no misreport is observed (0.792). Based on the result that senders tend to lie "to the bare minimum", we also check whether a similar fair-random strategy but one where the receiver insists on the value of the claimed hand to be greater than or equal to 12 (instead of 11) increases the receiver's expected payoff. We find that

[14]For the strategies in which the receiver uses a threshold acceptance rule based on the value of the observed card we present the threshold that gives the highest payoff and the two closest thresholds.

such a strategy does indeed lead to a higher receiver expected payoff (0.820) than the standard fair-random strategy (0.792).

Using messages to inform the checking decision is potentially beneficial. Table G6 shows that checking the high claim is better than checking the low claim (or checking at random). The best performing strategy in this category checks the high claim and accepts if a 7+ is observed (0.817). Interestingly, this is an optimal commitment strategy: if the sender best responds it leads to the GR outcome. The final category of strategies use messages for both checking and acceptance decisions. It turns out that it pays to use messages in this way. The best performing strategy is to check the higher claim and accept if and only if no misreport is observed, a good hand is claimed, and the observed value is 7+, and this gives a payoff of 0.848. This is also an optimal commitment strategy. Note that although there are multiple optimal commitment strategies, all leading to the GR outcome if the sender best responds, they do not perform equivalently given senders' observed behavior. In fact, using the message to inform acceptance pays off because it allows the receiver to take advantage of cases where the sender owns up to having a bad hand or misreports the high card. Insisting on the sum of the two cards being at least 12 does not improve on this outcome in this case (the expected payoff is equal to 0.819).

Result 14 *Given the sender's observed behavior in RV11, following an optimal commitment strategy of checking the higher claim and accepting if and only if no misreport is observed, a good hand is claimed, and the observed value is 7+, gives the receiver 99.41% of the empirical optimum.*

6 CONCLUSION

Sender-receiver games in which a sender's cheap talk claims are partially backed by evidence reflect many natural environments. In buyer-seller interactions a buyer is often exposed to a sales pitch or advertisements but can also test products (e.g. test-drive a car or download a sample of software). In lobbying environments, policy makers listen to claims of lobbyists but can also investigate claims. Such settings have been analysed in a growing theoretical literature, but they have attracted little experimental research. In this paper we introduce an experimental approach focusing on two theoretical models of Glazer and Rubinstein (2004, 2006).

While Glazer and Rubinstein focus on optimal mechanisms where the receiver can commit to a verification/acceptance rule, we focus on non-cooperative games in which the receiver cannot commit. We study two games in which a sender has private information about two aspects. These aspects determine whether the sender's type is good or bad, where the receiver's optimal action is to accept good types and reject bad types and all sender types want the receiver to accept. The sender makes claims about both aspects and the receiver, before making a decision, also gets evidence about one of them. The games differ in the control the receiver has over the observed evidence. In the Sender-Reveals game the sender chooses which cheap talk claim to back up with evidence, while in the Receiver-Verifies game the receiver chooses which cheap talk claim to verify.

We compare these partial evidence games with a Baseline where the sender makes an unverifiable claim about both aspects. This allows us to investigate the effect of evidence. Based on the theoretical analysis we expected a positive effect of evidence on information transmission and on receiver's payoff. Indeed, we find that senders transmit more information when messages are partially verifiable. Furthermore, although receivers don't take full advantage of this information, evidence significantly improves their average payoffs. Moreover, senders are not hurt by this, and in T11, they are also benefiting from partially verifiable messages.

Further, we investigate the effect of verification control by comparing the Sender-Reveals with the Receiver-Verifies game. Both games have multiple equilibria, including, but not limited to, equilibria that result in the same outcome as the optimal commitment strategy where all types with a strong enough aspect are accepted while the rest are rejected. Since this is the most informative equilibrium and it is common across the two games, we did not expect an effect of verification control. We find that in the Sender-Reveals game, senders almost always reveal their strongest aspect. When the sender's type is bad, they usually accompany this with an inflated claim about the weaker aspect. In Receiver-Verifies, senders also usually misreport when their type is bad. Receivers, as opposed to senders in the former setting, respond to the message with an auditing strategy - they are more likely to check the higher claim but check the lower claim about a third of the time.

This difference in verification strategies between senders and receivers could reflect differences in players' perceived role as "evidence choosers". While senders are trying to "persuade", in which case showing their strongest evidence looks compelling, perhaps receivers are trying to uncover deceitful senders ("inspect") and then verifying at random seems like a good heuristic. In fact, Glazer and Rubinstein (2004) show that for some non-convex distributions of good and bad sender types, randomization is necessary to achieve receiver's optimal outcome. Therefore, using a heuristic that is necessary for making good decisions in some cases and not too harmful in others may pay off if the cognitive effort to identify the optimal strategy in each particular case is too high.

In terms of the acceptance decision, receivers in Sender-Reveals almost always reject when senders claim to be a bad type. When senders claim to be a good type, acceptance behavior can be described as a "noisy best response": they are more likely to accept the higher the observed aspect, while the best response would be a threshold strategy. In Receiver-Verifies, receivers almost always reject if they uncover a misreport, and usually accept when the evidence is consistent with the sender's claim. This makes receivers in this setting significantly more lenient for any given value of observed evidence than in the former setting, conditional on no misreport being discovered. This difference could be due to a potential "illusion of control" (Langer, 1975) leading to an overconfidence in the efficiency of the auditing heuristic. Such lack of skepticism was also documented in disclosure games with competition among senders where receivers choose which sender to interact with (Penczynski and Zhang, 2018). This finding highlights the importance of studying how individuals weigh different types of information and how the evidence-gathering process might influence the associated weights.

The behavioral differences we observe in our data lead to notable outcome differences between the two evidence treatments. For example, the receiver is less likely to observe the strongest aspect in Receiver-Verifies, and acceptance behavior is more sensitive to the value observed in Sender-Reveals. This translates to several differences in payoffs: e.g., when the sender's type is bad but the sender has one sufficiently strong aspect, the receiver would fare better in Receiver-Verifies (and the sender in Sender-Reveals). Conversely, when the sender's type is bad and neither aspect is sufficiently strong, the receiver would fare better in Sender-Reveals (and the sender would fare better in Receiver-Verifies). Averaging over all types, there are no significant differences in receiver payoffs between treatments.

Hence, our findings support the counter-intuitive prediction that being able to choose which aspect to observe does not necessarily confer an advantage to the receiver (compared with delegating this to the sender). This is counter-intuitive because from a behavioral point of view, one could have expected that Receiver-

Verifies would be better for the receiver than Sender-Reveals. Controlling the verification helps the receiver uncover lies (which often correspond to bad hands), while in Sender-Reveals the sender makes sure that lies are rarely observed, so bad hands often have to be inferred by other means that may be cognitively more demanding. Moreover, from a theoretical point of view, the lowest equilibrium payoff for the receiver is lower when the receiver delegates verification control which also suggests the receiver may have been worse off in Sender-Reveals. We caution that the lack of benefits from controlling the verification action may be limited to our specific setting. In other settings, where cheap talk and evidence take more complex forms, or when full disclosure of information is possible, it may be more difficult for the receiver to perform as well when delegating control.

Finally, given the observed senders' behavior in our experiment, we find a simple receiver strategy for each game that would give the receiver more than 99% of her best possible payoff. For Sender-Reveals, the strategy involves accepting if and only if the sender claims a good type and the aspect revealed is sufficiently high. For Receiver-Verifies, this strategy involves checking the high claim, and accepting if and only if the observed aspect is sufficiently high, no misreport is detected, and the sender claims to be a good type. Interestingly, these strategies are optimal commitment strategies in a situation where the receiver can commit to verification/acceptance rules as shown by Glazer and Rubinstein (2004, 2006). Thus, the strategies they identify are not only theoretically optimal commitment strategies, they also provide good recommendations for how a receiver should play the two evidence games.

Abeler, J., Nosenzo, D., and Raymond, C. (2019). Preferences for truth-telling. *Econometrica*, 87(4):1115–1153.

Aristidou, A., Coricelli, G., and Vostroknutov, A. (2019). Incentives or persuasion? an experimental investigation. *Maastricht University GSBE Research Memorandum No. 012.*

Battaglini, M. (2002). Multiple referrals and multidimensional cheap talk. *Econometrica*, 70(4):1379–1401.

Benndorf, V., Kübler, D., and Normann, H.-T. (2015). Privacy concerns, voluntary disclosure of information, and unraveling: An experiment. *European Economic Review*, 75:43–59.

Blume, A., Lai, E. K., and Lim, W. (2020). Strategic information transmission: A survey of experiments and theoretical foundations. In Capra, C. M., Croson, R., Rigdon, M., and Rosenblat, T., editors, *Handbook of Experimental Game Theory*. Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, USA.

Cabrales, A., Feri, F., Gottardi, P., and Meléndez-Jiménez, M. A. (2020). Can there be a market for cheap-talk information? An experimental investigation. *Games and Economic Behavior*, 121:368–381.

Cai, H. and Wang, J. T.-Y. (2006). Overcommunication in strategic information transmission games. *Games and Economic Behavior*, 56(1):7–36.

Carroll, G. and Egorov, G. (2019). Strategic Communication with Minimal Verification. *Econometrica*, 87(6):1867–1892.

Crawford, V. P. and Sobel, J. (1982). Strategic information transmission. *Econometrica*, 50(6):1431–1451.

Fischbacher, U. (2007). z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2):171–178.

Forges, F. and Koessler, F. (2005). Communication equilibria with partially verifiable types. *Journal of Mathematical Economics*, 41(7):793–811.

Forsythe, R., Isaac, R. M., and Palfrey, T. R. (1989). Theories and tests of "blind bidding" in sealed-bid auctions. *The Rand Journal of Economics*, 20(2):214–238.

Forsythe, R., Lundholm, R., and Rietz, T. (1999). Cheap talk, fraud, and adverse selection in financial markets: Some experimental evidence. *The Review of Financial Studies*, 12(3):481–518.

Fréchette, G., Lizzeri, A., and Perego, J. (2022). Rules and commitment in communication: An experimental analysis. *Econometrica*, 90(5).

Gerlach, P., Teodorescu, K., and Hertwig, R. (2019). The truth about lies: A meta-analysis on dishonest behavior. *Psychological Bulletin*, 145(1):1.

Glazer, J. and Rubinstein, A. (2004). On optimal rules of persuasion. *Econometrica*, 72(6):1715–1736.

Glazer, J. and Rubinstein, A. (2006). A study in the pragmatics of persuasion. *Theoretical Economics*, 1:395–410.

Greiner, B. (2015). Subject pool recruitment procedures: organizing experiments with ORSEE. *Journal of the Economic Science Association*, 1(1):114–125.

Grossman, S. J. (1981). The Informational Role of Warranties and Private Disclosure about Product Quality. *The Journal of Law and Economics*, 24(3):461–483.

Hagenbach, J. and Perez-Richet, E. (2018). Communication with evidence in the lab. *Games and Economic Behavior*, 112:139–165.

Jin, G. Z., Luca, M., and Martin, D. (2021). Is No News (Perceived As) Bad News? An Experimental Investigation of Information Disclosure. *American Economic Journal: Microeconomics*, 13(2):141–73.

Kamenica, E. and Gentzkow, M. (2011). Bayesian persuasion. *American Economic Review*, 101(6):2590–2615.

King, R. R. and Wallin, D. E. (1991). Market-induced information disclosures: An experimental markets investigation. *Contemporary Accounting Research*, 8(1):170–197.

Lai, E. K., Lim, W., and Wang, J. T.-y. (2015). An experimental analysis of multidimensional cheap talk. *Games and Economic Behavior*, 91:114–144.

Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology*, 32(2):311.

Li, Y. X. and Schipper, B. C. (2020). Strategic reasoning in persuasion games: An experiment. *Games and Economic Behavior*, 121:329–367.

Lipman, B. L. and Seppi, D. J. (1995). Robust inference in communication games with partial provability. *Journal of Economic Theory*, 66(2):370–405.

Lipnowski, E. and Ravid, D. (2020). Cheap talk with transparent motives. *Econometrica*, 88(4):1631–1660.

Milgrom, P. R. (1981). Good News and Bad News: Representation Theorems and Applications. *The Bell Journal of Economics*, 12(2):380–391.

Minozzi, W. and Woon, J. (2013). Lying aversion, lobbying, and context in a strategic communication experiment. *Journal of Theoretical Politics*, 25(3):309–337.

Montero, M. and Sheth, J. D. (2021). Naivety about hidden information: An experimental investigation. *Journal of Economic Behavior and Organization*, 192:92–116.

Penczynski, S. P. and Zhang, S. (2018). Disclosure of Verifiable Information under Competition: An Experimental Study. *Mimeo*.

Sánchez-Pagés, S. and Vorsatz, M. (2007). An experimental study of truth-telling in a sender–receiver game. *Games and Economic Behavior*, 61(1):86–112.

Sheth, J. D. (2021). Disclosure of information under competition: An experimental study. *Games and Economic Behavior*, 129:158–180.

Shin, H. S. (1994). News management and the value of firms. *The RAND Journal of Economics*, pages 58–71.

Shin, H. S. (2003). Disclosures and asset returns. *Econometrica*, 71(1):105–133.

Vespa, E. and Wilson, A. J. (2016). Communication with multiple senders: An experiment. *Quantitative Economics*, 7(1):1–36.

APPENDIX

A SEQUENTIAL EQUILIBRIUM DEFINITION

A.1 *The Baseline game*

A sequential equilibrium consists of a sender's message strategy $\sigma(m|x)$, a receiver's decision rule $d(m)$, and receiver's beliefs after each message $b(x|m)$, satisfying the conditions below:

(i) (*Sender sequential rationality*) For all $x \in X$, $m \in M$, $\sigma(m|x) > 0 \implies m \in \arg\max_{m' \in M} U_S(m'|x)$, where $U_S(m'|x) = d(m')$ is the probability that type x is accepted if he sends message m' given the receiver's strategy.

(ii) (*Receiver sequential rationality*) For all $m \in M$, the receiver sets $d(m) = 1$ if $\sum_{x \in G} b(x|m) > 0.5$, and $d(m) = 0$ if $\sum_{x \in G} b(x|m) < 0.5$.

(iii) *(Consistency of receiver beliefs) For all $x \in X$, $m \in M$,*

$$b(x|m) = \frac{\sigma(m|x)p_x}{\sum_{z \in X} \sigma(m|z)p_z} \text{ whenever } \sum_{z \in X} \sigma(m|z)p_z > 0.$$

Condition (i) requires that the sender only sends messages that maximize the probability that the receiver accepts. Condition (ii) requires that the receiver takes the action that maximizes the probability of taking the right decision (i.e., accepting a good type or rejecting a bad type) given the beliefs for the message received. Condition (iii) states that the receiver's beliefs must be determined by Bayes rule whenever possible, given the prior and sender's strategy. If $\sum_{z \in X} \sigma(m|z)p_z = 0$, no sender type ever sends message m, so the receiver's beliefs are not constrained by Bayes rule. The sequential equilibrium refinement does not bite either, since it is possible to support any beliefs as the limit of a sequence.

A.2 *The RV game*

An equilibrium consists of a sender's message strategy $\sigma(m|x)$, a receiver's checking rule $\pi_1(m)$, a receiver's decision rule for each aspect, $d_1(m, y_1)$ and $d_2(m, y_2)$, where y_k is the observed value of aspect $k = 1, 2$, receiver's beliefs after each message, $b(x|m)$, and receiver's beliefs after having checked an aspect, $b_1(x|m, y_1)$ and $b_2(x|m, y_2)$, satisfying the conditions (i)-(v) below.

In what follows, denote by $b_k(y_k|m) = \sum_{x:x_k=y_k} b(x|m)$ the belief probability the receiver assigns to observing value y_k if she checks aspect k after receiving message m.

Also, denote by $g_k(m, y_k) = \sum_{x \in G} b_k(x|m, y_k)$ the belief probability that the receiver assigns to the sender being a good type after having received message m, checked aspect k and observed value y_k.

(i) (Sender sequential rationality) For all $x \in X$, $m \in M$, $\sigma(m|x) > 0 \Rightarrow m \in \arg\max_{m' \in M} U_S(m'|x)$, where $U_S(m'|x) = \pi_1(m')d_1(m', x_1) + [1 - \pi_1(m')]d_2(m', x_2)$ is the probability that type x is accepted if he sends message m', given the receiver's strategy.

(ii) *(Sequential rationality of the receiver's decision rule)* For all $m \in M$, $y_k \in X_k$ and $k = 1, 2$, the receiver sets $d_k(m, y_k) = 1$ if $g_k(m, y_k) > 0.5$, and $d_k(m, y_k) = 0$ if $g_k(m, y_k) < 0.5$.

(iii) *(Sequential rationality of the receiver's checking rule)*

For all $m \in M$, $\pi_1(m) = 1$ if

$$\begin{aligned} & \sum_{y_1} b_1(y_1|m)[d_1(m, y_1)g_1(m, y_1) + [1 - d_1(m, y_1)][1 - g_1(m, y_1)]] \\ > & \sum_{y_2} b_2(y_2|m)[d_2(m, y_2)g_2(m, y_2) + [1 - d_2(m, y_2)][1 - g_2(m, y_2)]] \end{aligned}$$

and $\pi_1(m) = 0$ if

$$\begin{aligned} & \sum_{y_1} b_1(y_1|m)[d_1(m, y_1)g_1(m, y_1) + [1 - d_1(m, y_1)][1 - g_1(m, y_1)]] \\ < & \sum_{y_2} b_2(y_2|m)[d_2(m, y_2)g_2(m, y_2) + [1 - d_2(m, y_2)][1 - g_2(m, y_2)]] \end{aligned}$$

(iv) *(Consistency of receiver beliefs after receiving the message)*

For all $x \in X$, $m \in M$,

$$b(x|m) = \frac{\sigma(m|x)p_x}{\sum_{z \in X} \sigma(m|z)p_z} \text{ whenever } \sum_{z \in X} \sigma(m|z)p_z > 0.$$

(v) *(Consistency of receiver beliefs after having checked an aspect)*

For each $k = 1, 2$ it holds that $b_k(x|m, y_k) = 0$ for all x such that $x_k \neq y_k$, and

$$b_k(x|m, y_k) = \frac{\sigma(m|x)p_x}{\sum_{z:z_k=y_k} \sigma(m|z)p_z} \text{ whenever } \sum_{z:z_k=y_k} \sigma(m|z)p_z > 0 \text{ and } x_k = y_k.$$

Condition (i) requires that the sender only sends messages that maximize the probability that the receiver accepts. Condition (ii) requires that the receiver takes the action that maximizes the probability of taking the right decision (i.e., accepting a good type or rejecting a bad type) given the message, the aspect checked, the value observed and the beliefs. In order to do this, the receiver should accept if she believes that the type is more likely to be good than bad, and reject if she believes the type is more likely to be bad. Condition (iii) requires that, given the receiver's beliefs after receiving the message, the receiver checks the aspect that maximizes the probability of taking the right decision.

Conditions (iv) and (v) state that the receiver's beliefs must be determined by Bayes rule whenever possible, given the prior and the players' strategies. Condition (iv) is identical to the corresponding condition in Baseline. Condition (v) requires that the receiver rules out sender types with $x_k \neq y_k$ after observing y_k; for other types, the belief probability is the ratio of the probability that the sender is of type x and sends message m divided by the overall probability that the sender is of a type with $z_k = y_k$ and sends message m. If message m is never sent by a type with $z_k = y_k$, the receiver's beliefs are not constrained except by the value y_k itself (i.e., the receiver may have any beliefs as long as the total probability of 1 is distributed among types with $z_k = y_k$).

A.3 *The SR game*

An equilibrium consists of a sender's message strategy $\sigma(m|x)$, a sender's revelation rule $\rho_1(x,m)$ (with $\rho_2(x,m) := 1 - \rho_1(x,m)$), a receiver's decision rule for each aspect revealed, $d_1(m, y_1)$ and $d_2(m, y_2)$, where y_k is the observed value of aspect $k = 1, 2$, and receiver's beliefs after receving the message and observing the actual value of an aspect, $b_1(x|m, y_1)$ and $b_2(x|m, y_2)$, satisfying the conditions (i)-(iii) below.

Let $\sigma(m,k|x) = \sigma(m|x)\rho_k(x,m)$ denote the probability that type x sends message m and reveals aspect k. Analogously to RV, denote by $g_k(m, y_k) = \sum_{x \in G} b_k(x|m, y_k)$ the belief probability that the receiver assigns to the sender being a good type given that the sender sends message m, reveals aspect k and the observed value is y_k.

(i) Sender sequential rationality

For any type $x \in X$, any message $m \in M$ and any aspect $k = 1, 2$, $\sigma(m,k|x) > 0$ implies $d_k(m, x_k) \geq d_j(m', x_j)$ for all $m' \in M$, $j = 1, 2$.

(ii) *Receiver sequential rationality*

For all $m \in M$, $y_k \in X_k$ and $k = 1, 2$, the receiver sets $d_k(m, y_k) = 1$ if $g_k(m, y_k) > 0.5$, and $d_k(m, y_k) = 0$ if $g_k(m, y_k) < 0.5$.

(iii) *Consistency of receiver beliefs*

For each $k = 1, 2$ it holds that $b_k(x|m, y_k) = 0$ for all x such that $x_k \neq y_k$, and

$$b_k(x|m, y_k) = \frac{\sigma(m,k|x)p_x}{\sum_{z:z_k=y_k} \sigma(m,k|z)p_z} \text{ whenever } \sum_{z:z_k=y_k} \sigma(m,k|z)p_z > 0 \text{ and } x_k = y_k.$$

Condition (i) states that the sender strategy maximizes the probability of acceptance. If a combination of message and aspect being revealed has positive probability, it must be the case that the sender cannot do better by sending a different message and/or revealing a different aspect.

Condition (ii) is identical to the corresponding condition in RV.

Condition (iii) is analogous to the corresponding condition in RV, but not identical. Given that the sender decided to reveal aspect k and that the value of aspect k is y_k, the receiver must rule out all types x with $x_k \neq y_k$. For sender types with $x_k = y_k$, the probability that the sender is of type x equals the probability that the sender sends message *m and reveals aspect k*, divided by the total probability that a sender has value y_k of aspect k and reveals aspect k. When the sender reveals, two senders with the same value of aspect k may send the same message but have different probabilities of revealing aspect k; when the receiver chooses which aspect is observed, any two senders that send the same message must induce the same probability of observing aspect k, since the receiver has no way to distinguish the two cases.

B EQUILIBRIA OF THE BASELINE GAME

Sequential equilibrium makes sharp predictions about the receiver's strategy on the equilibrium path: The receiver follows the optimal decision according to the prior, that is, always accepts in T9, and always rejects in T11.

Remark 3 *(Baseline T11) In any sequential equilibrium, the receiver's strategy is such that* $d(m) = 0$ *for all* $m \in M$.

Suppose, by contradiction, that $d(m) > 0$ for some message m in a sequential equilibrium of T11. Since the sender chooses a message that maximizes the probability of acceptance, all sender types must be sending a message with a positive (indeed, maximal) acceptance probability.

Let m be one of such messages with $d(m) > 0$. In order for the receiver's strategy to be optimal, the probability that the sender has a good hand conditional on message m being sent must be at least 0.5, that is $\frac{\sum_{x \in G} \sigma(m|x) p_x}{\sum_{x \in X} \sigma(m|x) p_x} \geq 0.5$, or equivalently (since all hands are equally likely) $\sum_{x \in G} \sigma(m|x) \geq \sum_{x \in X \setminus G} \sigma(m|x)$. If the sender is following a pure strategy, this can be read as "there are at least as many good hands as bad hands sending m ". This has to hold for all messages that are sent in equilibrium, which is not possible since in T11 there are more bad hands than good hands (so, whichever way the sender mixes, it must be the case that for at least one message the hand is more likely to be bad than good). The receiver must also reject with certainty for messages off the equilibrium path; otherwise the sender could gain from deviating.

Remark 4 *(Baseline T9) In any sequential equilibrium, the receiver's strategy is such that* $d(m) = 1$ *for all* m *such that* $\sigma(m|x) > 0$ *for some* x.

Since there are more good hands than bad hands in T9, irrespective of the sender's messaging strategy, there must be a message for which the hand is strictly more likely to be good than bad. Sequential rationality of the receiver strategy and consistent beliefs imply that the receiver must accept with certainty when this message is received. Thus, there is at least one message that leads to the receiver accepting for sure in any sequential equilibrium of the baseline. Sequential rationality of the sender's strategy then implies that all messages sent in equilibrium must lead to acceptance with certainty. While all messages that are observed in equilibrium must be accepted, messages for which $d(m) < 1$ may exist off the equilibrium path.

Equilibrium predictions about the sender's messaging strategy are less sharp. For both thresholds, it is not necessarily the case that the sender always sends the same message, or a completely uninformative message. However, messages sent in equilibrium cannot change the receiver's optimal strategy according to the prior (in the terminology of Lipnowski and Ravid (2020), communication may be informative but it is neither beneficial nor harmful for the sender).

C OPTIMAL COMMITMENT STRATEGIES IN RV AND SR GAMES

C.1 *Receiver-Verifies*

We will apply Glazer and Rubinstein (2004) proposition 0 (the L-principle). Glazer and Rubinstein define an L-set to be a set of three types, where $x \in G$, $y \in X \backslash G$ and $z \in X \backslash G$, such that $x_1 = y_1$ and $x_2 = z_2$, that is, each of the bad types differs from the good type in the value of exactly one aspect. The idea of the L-principle is that, since the receiver can only verify one aspect and the sender best replies to the strategy of the receiver, the receiver must make a mistake for at least one of these three types. Either the good type x is rejected, in which case the receiver is making an error for this type, or the good type x is accepted after the receiver checks aspect 1 (in which case the bad type y must be accepted as well, since a sender of type y would have the option of pooling with type x), or the good type x is accepted after the receiver checks aspect 2 (in which case the bad type z must be accepted as well, since a sender of type z would then be able to pool with type x). A consequence of proposition 0 is that, when the prior probability distribution is uniform as in our case, "an optimal mechanism can be found by using a technique that relies on the L-principle: finding a mechanism that induces H mistakes, and finding H disjoint L-sets" (Glazer and Rubinstein, 2004, p. 1721). The number of disjoint L-sets sets a lower bound on the receiver's mistake probability. Thus, the L-principle ensures that a mechanism leading to the same number of mistakes as the number of disjoint L-sets is optimal for the receiver.[15]

Table C1 shows the set of possible types in our game, and indicates the good types by the letter G for T11. We mark 15 disjoint L-sets (the three elements of each L are indicated by the same number; for example, types $(9, 2)$, $(9, 1)$ and $(1, 2)$ constitute and L-set). Thus, by the L-principle, there is no commitment strategy that yields fewer than 15 mistakes when the sender best responds. A receiver commitment strategy that, when the sender best responds to it, results in all types with 7+ being accepted and all other types being rejected implies 15 mistakes for the receiver, and hence is an optimal commitment strategy. An example of such a strategy

[15]The reference to the "number of mistakes" suggests a deterministic strategy on the part of the receiver. Glazer and Rubinstein point out on p. 1721 that when the prior distribution of types is uniform, the optimal mechanism does not require randomization when the sender's aim is to persuade the receiver that the average [or, equivalently, the sum] of the two aspects is above a certain threshold.

is checking the higher claim and accepting if and only if the aspect observed is 7+. Our example is analogous to Example 2 in Glazer and Rubinstein (2004) and the table below is analogous to Figure 2 in Glazer and Rubinstein (2004). Note that our notation differs slightly from theirs: we denote the set of good types by G, while they denote it by A.

Table C1: Disjoint L-sets for T11

	9	15	G15	G	G	G	G	G	G	G
	8	13	14	G13	G14	G	G	G	G	G
	7	10	11	12	G10	G11	G12	G	G	G
	6	9	8	6		G9	G8	G6	G	G
x_2	5	5	7				G7	G5	G	G
	4	3	4					G4	G3	G
	3	2					12	6	G2	G
	2	1			10	9	8	5	3	G1
	1		15	13	14	11	7	4	2	1
		1	2	3	4	5	6	7	8	9
						x_1				

For T9, there are 9 disjoint L-sets as shown in Table C2. An example of an optimal commitment strategy for the receiver is checking the higher claim and accepting if and only if the aspect observed is 6+.

Table C2: Disjoint L-sets for T9

	9	G	G	G	G	G	G	G	G	G
	8	G	G	G	G	G	G	G	G	G
	7	9	G9	G	G	G	G	G	G	G
	6	7	8	G7	G8	G	G	G	G	G
x_2	5	6	5		G6	G5	G	G	G	G
	4	3	4			G4	G3	G	G	G
	3	2					G2	G	G	G
	2	1			8	5	3	G1	G	G
	1		9	7	6	4	2	1	G	G
		1	2	3	4	5	6	7	8	9
						x_1				

C.2 *Sender-Reveals*

Glazer and Rubinstein (2006) show that the same L-principle technique can be applied to the game where the sender chooses which aspect to reveal (see Lemma 2 on p. 400 of their paper; note also that their Proposition 1 shows that there is an optimal commitment strategy that is deterministic, so there is no loss in focusing on deterministic commitment strategies). Therefore, as per the above analysis for the RV game, a commitment strategy that, when the sender best responds, induces 15 mistakes (for T11) or 9 mistakes (for T9) is an optimal commitment strategy for the receiver. An example of such a strategy is to ignore the message and accept if and only if a 7+ aspect (for T11) or a 6+ aspect (for T9) is revealed. This strategy results in hands with a 7+ aspect (6+ aspect) being accepted and other hands being rejected, just as the strategy we presented for RV.

D PROOF THAT THE GR OUTCOME CAN BE SUPPORTED AS A SEQUENTIAL EQUILIBRIUM

There are multiple sequential equilibria resulting in the GR outcome in both games. In this section we describe two equilibria that differ in the role of messages for each game.

D.1 *Receiver verifies*

We start by presenting a sequential equilibrium in which the message informs the checking decision (by pointing the receiver to a sufficiently high aspect if the sender has one), but the acceptance decision is independent of whether the value observed coincides with the message.

D.1.1 *A sequential equilibrium leading to the GR outcome where the message is used for the checking decision only*

We will discuss the T11 case in detail; the T9 case is analogous. Let the sender's message strategy be as in Table D1 below, where the first entry in a cell is the reported value of x_1, and the second entry is the reported value of x_2; for empty cells the sender randomizes between messages (1,9) and (9,1).

Table D1: An equilibrium sender strategy in RV11

	9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	
	8	1,9	1,9	1,9	1,9	1,9	1,9	1,9		9,1
	7	1,9	1,9	1,9	1,9	1,9	1,9		9,1	9,1
	6							9,1	9,1	9,1
x_2	5							9,1	9,1	9,1
	4							9,1	9,1	9,1
	3							9,1	9,1	9,1
	2							9,1	9,1	9,1
	1							9,1	9,1	9,1
		1	2	3	4	5	6	7	8	9
						x_1				

In words, the sender's strategy only uses two messages. If both aspects are equal, or if the sender has no 7+ aspect, the sender sends one of the two messages at random. Otherwise the sender reports the higher value as 9 and the lower value as 1.

We now construct a strategy for the receiver such that the sender and receiver strategies, together with appropriate beliefs, constitute a sequential equilibrium.

The receiver's checking strategy is to check the higher claim, checking at random if both reports are equal. The acceptance strategy for messages $(9, 1)$ and $(1, 9)$ is as follows: conditional on having checked the higher claim, accept if and only if a 7+ value is observed. Conditional on having checked the lower claim (i.e., conditional on the receiver having deviated from their own checking strategy), accept if and only if a 5+ value is observed. For messages other than $(9, 1)$ and $(1, 9)$, the acceptance strategy is to accept if and only if a 7+ is observed irrespective of what claim was checked. We now check the optimality of the receiver's acceptance strategy, starting from subgames on the equilibrium path.

Suppose the message was $(9, 1)$ (the case $(1, 9)$ is analogous) and, having checked the higher claim (i.e. the first aspect), the receiver observes a value of 7. Given the messaging strategy it is not possible for the value of the second aspect to be 8 or 9 (those sender types send message $(1, 9)$). The second aspect may be any value from 1 to 7; those values are equally likely except 7 itself, which is only half as likely given that types of the form $(7, x_2)$ with $x_2 < 7$ send message $(9, 1)$ while type $(7, 7)$ randomizes between $(9, 1)$ and $(1, 9)$. The probability of a good type is then $\frac{3.5}{6.5} = \frac{7}{13} > 0.5$, hence it is optimal for the receiver to accept, which is what the acceptance strategy specifies. An analogous reasoning applies if the value observed is 8 or 9 (the corresponding probabilities of a good type are $\frac{11}{15}$ and $\frac{15}{17}$).

Now suppose the message was $(9, 1)$ and, having checked the first aspect as the checking rule specifies, the receiver observes a value of 6. Given the sender's messaging strategy, the second aspect may be 1, 2, 3, 4, 5 or 6, and all these values have the same probability because types of the form $(6, x_2)$ with $x_2 \leq 6$ send message $(9, 1)$ with probability 0.5, while types of the form $(6, x_2)$ with $x_2 > 6$ never send message $(9, 1)$. The probability that the type is good is then equal to $\frac{2}{6}$, and it is optimal for the receiver to reject, which is what the acceptance strategy specifies. An analogous reasoning applies if the value observed is 5 or less (the corresponding probabilities of a good type are $\frac{1}{6}$ if 5 is observed and 0 if 4 or less is observed).

Still dealing with subgames on the equilibrium path, let us look at the optimality of the receiver's checking strategy, conditional on having received message $(9,1)$ or $(1,9)$. The receiver's checking strategy is optimal if it minimizes the overall probability of error. The overall probability of error is the probability of error conditional on the observed value, weighted by the probability of observing that particular value. The tables below show these probabilities conditional on message $(9,1)$ or $(1,9)$ being received, depending on whether the receiver checks the higher claim (Table D2) or the lower claim (Table D3).

In Table D2 below, the first column contains each possible value that may be observed. The second column contains the probability of observing each value; this probability depends on the sender's messaging strategy and on the fact that the receiver is checking the higher claim. The third column contains the probability of a good type conditional on the observed value. The fourth column gives the probability of error that results from the receiver's acceptance strategy for each possible observed value. The overall probability of error if the receiver checks the aspect reported as 9 and takes the optimal acceptance decision can then be calculated as $\frac{6}{81} \cdot \frac{1}{6} + \frac{6}{81} \cdot \frac{1}{3} + \frac{13}{81} \cdot \frac{6}{13} + \frac{15}{81} \cdot \frac{4}{15} + \frac{17}{81} \cdot \frac{2}{17} = \frac{5}{27}$.

Table D2: Probabilities after receiving (1,9) or (9,1) and checking the higher claim in RV11

y_i	Prob(y_i)	Prob($GoodHand \mid y_i$)	Prob($Error \mid y_i$)
1	$\frac{6}{81}$	0	0
2	$\frac{6}{81}$	0	0
3	$\frac{6}{81}$	0	0
4	$\frac{6}{81}$	0	0
5	$\frac{6}{81}$	$1/6$	$1/6$
6	$\frac{6}{81}$	$1/3$	$1/3$
7	$\frac{13}{81}$	$7/13$	$6/13$
8	$\frac{15}{81}$	$11/15$	$4/15$
9	$\frac{17}{81}$	$15/17$	$2/17$

If the receiver checks the lower claim after receiving message $(9,1)$ or $(1,9)$, the relevant probabilities can be found in Table D3 below. The table also illustrates that accepting if the observed aspect is 5+ is optimal in this situation, precisely what the receiver's strategy specifies. The overall error probability if the receiver checks the lower claim and takes the optimal acceptance decision is $\frac{7}{27}$, which is above $\frac{5}{27}$. This shows the optimality of the checking strategy of the receiver conditional on having received message $(9,1)$ or $(1,9)$: the receiver is less likely to make an error by checking the higher claim.

Table D3: Probabilities after receiving (1,9) or (9,1) and checking the lower claim in RV11

y_i	Prob(y_i)	Prob($GoodType \vert y_i$)	Prob($Error \vert y_i$)
1	$\frac{12}{81}$	0	0
2	$\frac{12}{81}$	1/6	1/6
3	$\frac{12}{81}$	1/3	1/3
4	$\frac{12}{81}$	0.5	0.5
5	$\frac{12}{81}$	7/12	5/12
6	$\frac{12}{81}$	2/3	1/3
7	$\frac{5}{81}$	1	0
8	$\frac{3}{81}$	1	0
9	$\frac{1}{81}$	1	0

We have established the optimality of the receiver's checking and acceptance strategies conditional on message $(9,1)$ or $(1,9)$ being received. Receiver beliefs about the probability of a good type or about the probability of observing each value follow directly from the strategies and Bayes rule.

There are other information sets that are not reached given the strategy of the sender, namely information sets where messages other than $(9,1)$ and $(1,9)$ are used. We can construct a sequence of fully mixed strategies for the sender that converge to the strategy played, and that would induce beliefs that would make it optimal for the receiver to check the higher claim and accept if and only if the observed value is 7+, also for other messages.[16]

For example, consider the following fully mixed strategy: senders with a 7+ aspect send the message prescribed by Table C1 with probability $1-\varepsilon$ and randomize between all 81 messages with the remaining probability; senders with no 7+ aspect send the message prescribed by Table C1 with probability $1-2\varepsilon$ and randomize between all 81 messages with the remaining probability. Receiver's beliefs for messages other than $(9,1)$ and $(1,9)$ are constructed from this fully mixed strategy using Bayes rule.

[16] In principle we would also need to specify a fully mixed strategy for the receiver but the details of this strategy are of no consequence. For example, let the receiver check the higher claim with probability $1-\varepsilon$ and then take the optimal acceptance decision with probability $1-\varepsilon$.

This sender strategy clearly converges to the strategy specified earlier as $\varepsilon \to 0$. Furthermore, if a message other than $(9,1)$ or $(1,9)$ is received, it does not matter which of the two reports is checked, hence the receiver may as well check the higher claim if the two reports are different, and check at random if they are equal (the probability of observing each of the 9 possible values of an aspect and the probability of a good type conditional on the value observed do not depend on which claim is checked). As for the acceptance strategy, accepting if and only if the value observed is $7+$ is still optimal. In particular, if a value of 6 is observed, given that types without a $7+$ aspect are disproportionately likely to deviate, the type is slighly more likely to be bad than good. This is crucial since otherwise the receiver would accept 6 given a message other than $(9,1)$ and $(1,9)$, and the sender would then have an incentive to deviate.[17]

The case T9 is analogous, with 6 replacing 7 as the relevant cutoff value. The sender randomizes between (1,9) and (9,1) if both aspects are equal, or if the sender has no 6+ aspect, and reports the higher card as 9 and the lower card as 1 otherwise. Conditional on receiving one of those messages and checking the higher claim, it is optimal for the receiver to accept if and only if the value observed is 6+. If the receiver checks the lower claim instead, it is optimal to accept if and only if the value observed is 3+. Checking the higher claim leads to a lower probability of error for the receiver (9/81 compared to 22/81).

D.1.2 *A sequential equilibrium leading to the GR outcome where the receiver uses the message to inform both the checking and the acceptance strategy*

As in the previous section, we will discuss the T11 case in detail, and briefly present the T9 at the end. The sender's messaging strategy for T11 is in Table 2.

The receiver's strategy is to check the higher claim (checking at random if both reports are equal) and accept if and only if a good type is reported, the observed value coincides with the claim and the observed value is 7+.[18]

[17] If a value of 6 is observed, the other aspect may be any value between 1 and 9 but the distribution is not uniform. Each value between 1 to 6 is twice as likely to occur as each value between 7 and 9, hence the probability of a good type conditional on observing a value of 6 would be $7/15$. If a 7 is observed, we know a sender type with a 7+ aspect has deviated, and the other aspect is equally likely to be any value between 1 and 9; the probability of a good type is then $6/9$.

[18] The 7+ threshold is relaxed at some information sets that are not reached in equilibrium, see below.

The sender's strategy is optimal since, given the receiver's strategy, it results in all sender types with a 7+ being accepted; this is the best the sender can do given that the receiver's strategy conditions acceptance on observing a 7+ aspect, so senders with no 7+ aspect cannot be accepted.

As for the receiver strategy, let us begin by the subgames in which the sender is sticking to the messaging strategy in Table 2. In some of the cells (for example $(4,4)$) the sender is reporting a bad type. All bad type reports in Table 2 are sent by senders with bad types, hence it is optimal for the receiver to (check the higher claim and) reject, which is what the strategy specifies. In other cells (for example $(9,5)$) the sender has a good type and is reporting it truthfully; no other sender type is sending the same message, so it is optimal for the receiver to (check the higher claim and) accept.[19] Finally, there are messages such that the sender is reporting a good type, and these messages are sent by several sender types. The types that send those messages form an L-set (cf Table B1). For example, if the message received is (9,2), the receiver's prescribed strategy is to check the higher claim and, if the value observed is indeed a 9, accept. Conditional on the message and on observing a 9, the type is equally likely to be (9,2) and (9,1), so it is optimal for the receiver to accept; if a 1 is observed, the type is sure to be a bad type, hence the receiver should reject which is what the strategy specifies. Could the receiver have done better by checking the lower claim upon receiving message (9,2)? Conditional on observing a value of 2, the type is equally likely to be (9,2) and (1,2); it is (weakly) optimal to reject as the strategy specifies. If a 1 is observed, the type is sure to be (9,1) given the sender's strategy, and it is optimal to reject as the strategy specifies. Overall, the probability of error is $1/3$ irrespective of which message is checked (the receiver erroneously accepts type $(9,1)$ if the higher claim is checked and erroneously rejects type $(9,2)$ if the lower claim is checked), so it is optimal to check the higher message. Something analogous happens for messages like $(6,6)$, where the sender reports a good type but the receiver rejects. After checking either message, if a 6 is observed the type has an equal probability of being good or bad and it is weakly optimal to reject; if a 2 is observed instead, the type is sure to be a bad type and it is optimal to reject.

[19] Similarly to the previously described equilibrium, there is some relaxation of the acceptance threshold at information sets where the receiver deviates from their own checking strategy. Since there are messages that are only sent by good types, the receiver's acceptance strategy if the lower claim is checked is to accept if one of those messages are received and the value observed coincides with the message. The receiver cannot gain from checking the lower claim for these messages.

Note that not all messaging strategies where the sender reports good types truthfully and inflates bad types with a 7+ aspect would induce a sequential equilibrium. For example, consider message (7,4). The strategy described above requires the receiver to check the first card and accept if it is 7. However, having checked that the 7 is correct does not imply that the receiver should necessarily accept. If the sender only inflates bad types up to the bare minimum needed to make up a good type, after receiving message (7,4) and verifying that the 7 is correct, the type is equally likely to be (7,4), (7,3), (7,2) and (7,1). Only one out of four is a good type, hence the receiver should reject. In order to have an equilibrium, the sender cannot concentrate the lies on messages that add up exactly to the threshold; one possibility is that (7,3) reports (7,6), (7,2) reports (7,5) and (7,1) reports (7,4) as in the table.

The sender's strategy should also be such that it is optimal for the receiver to always verify the aspect with the highest claimed value. For example, if the message (7,4) were sent only by the (7,4) and (7,1) types, the receiver would want to check the 4 since that would ensure discovering the bad type. The equilibrium would require some types (e.g. (2,4), as in Table 2) to send (7,4) as well even though it has no benefit for them. All types that send a bolded message in Table 2 are lying not because it is (strictly) profitable to do so, but in order to preserve the optimality of the receiver's strategy.

The equilibrium described also requires the receiver to reject some good types, such as (6,6). If (6,6) is the only type that sends message (6,6), the receiver would know that this is a good type and should accept instead. In order to have an equilibrium, one needs to assume that either (6,6) reports one of the aspects as 7+ (even though this will be discovered for sure given the strategy of the receiver) or there are bad types that also report (6,6), (as in Table 2), so that a claim of (6,6) is not unambiguously a good type. In both cases, there are sender types that are lying even though they have nothing to gain from doing so.

In all the subgames above, the sender is sticking to their prescribed strategy and the receiver's beliefs follow by Bayes rule.

We now turn to the optimality of the receiver strategy for combinations of values and messages that cannot be observed given the sender strategy (this involves all messages that are never sent by the sender in equilibrium as well as cases such as receiving message $(9,2)$ and, having checked the first aspect, observing a value of 5). The definition of sequential equilibrium requires the receiver to have beliefs that make it optimal for the receiver to check the higher claim and (irrespective of what claim was checked) accept if and only if a good type is reported, the value observed coincides with the claim, and the value observed is 7+.

Let the receiver beliefs place probability 1 on the type being bad for all those situations that have 0 probability given the sender's strategy. In order to have a sequential equilibrium, these beliefs must be obtainable as the limit of a sequence of beliefs, which themselves are derived (by Bayes rule) from a sequence of fully mixed sender strategies that converge to the strategy in Table 2.

The auxiliary sequence of fully mixed strategies for the sender is as follows. Senders with a good type send the message prescribed by Table 2 with probability $1 - \varepsilon^2$ and randomize between all 81 messages with the remaining probability; senders with a bad type send the message prescribed by Table 2 with probability $1 - \varepsilon$ and randomize between all 81 messages with the remaining probability. Receiver beliefs are the limit when $\varepsilon \to 0$ of the beliefs that follow from this sequence by Bayes rule. At any subgame that cannot be reached given the sender strategy, the receiver is certain that the type is bad.

For example, suppose the receiver gets message $(7,4)$ and, upon checking the higher claim, observes a 9. The receiver then believes that the type is certain to be $(9,1)$, and rejects. This belief can be constructed as the limit when $\varepsilon \to 0$ of $\frac{\frac{1}{81}\varepsilon}{\frac{1}{81}\varepsilon+\frac{8}{81}\varepsilon^2} = \frac{1}{1+8\varepsilon}$. Hence, we can construct beliefs that justify the receiver rejecting when the observed value does not coincide with the message, even if the observed value is 7+. Analogously, if the receiver gets a message that is not in Table 2 such as $(8,2)$, the receiver believes that the message comes from a bad type, even if the observed value coincides with the claim. Note that all messages not used in Table 2 correspond to reported bad types. The beliefs we have constructed make it optimal for the receiver to reject when a bad type is reported, irrespective of the observed value or of whether it coincides with the claim.

The checking strategy is also optimal off the equilibrium path. If a message off the equilibrium path is observed, the receiver is indifferent between checking the higher and the lower claim, so may as well check the higher claim.

The equilibrium we have described is the most informative in the sense that it leads to the finest partition available to the receiver at the time of the acceptance decision. In this equilibrium most messages are sent by only one type, so that the receiver learns the sender's type directly from the message. In addition, there are 15 messages that are sent by three types each. After receiving one of those messages (e.g., $(9,2)$) the receiver knows that the type is either $(9,2)$, $(9,1)$ or $(1,2)$. After checking the first aspect, the receiver either learns that the type is $(1,2)$, or learns that it is either $(9,2)$ or $(9,1)$. Hence, at the time of the acceptance decision, the receiver knows the sender type with certainty except for 15 pairs of types that the receiver cannot distinguish. No finer partition is possible in equilibrium, since, by Glazer and Rubinstein's (2004) L-principle, the receiver must make at least 15 errors (see Appendix C.1).

For T9, Table D4 contains the sender's strategy in an equilibrium where both the checking and the acceptance decision depend on the message. Most of the messages are sent by one hand only, and those messages are truthful. In addition, there are 9 messages that are sent by three different types (one good type and two bad types) corresponding to an L-set in Table C2. The corresponding equilibrium receiver strategy is to check the higher claim and accept if and only if a good hand is reported and the value observed coincides with the claim and is 6+.[20] Also as in T11, this is the most informative equilibrium since the receiver learns the sender type except for 9 pairs of sender types that the receiver cannot distinguish, and the L-principle implies that the receiver cannot make less than 9 errors in any equilibrium.

D.2 *Sender reveals*

D.2.1 *A sequential equilibrium leading to the GR outcome where the acceptance decision does not depend on the message*

The sender sends one of the 81 possible messages at random, and reveals the aspect with the higher value (revealing one aspect at random if both aspects have the same

[20] As in the case of T11, there is some relaxation of the acceptance threshold at information sets where the receiver deviates from their own checking strategy. Also as in T11, an auxiliary sequence of fully mixed strategies can be constructed by assuming that bad types are disproportionately likely to deviate; this makes it optimal for the receiver to reject when a bad hand is reported or when the value observed does not coincide with the claim. Note also that the requirement that the value observed coincides with the claim does not apply to values 8 and 9 because the hand is certain to be good in this case.

Table D4: Example of an equilibrium sender's message strategy in RV9

	9	(1,9)	(2,9)	(3,9)	(4,9)	(5,9)	(6,9)	(7,9)	(8,9)	(9,9)
	8	(1,8)	(2,8)	(3,8)	(4,8)	(5,8)	(6,8)	(7,8)	(8,8)	(9,8)
	7	(2,7)	(2,7)	(3,7)	(4,7)	(5,7)	(6,7)	(7,7)	(8,7)	(9,7)
	6	(3,6)	(4,6)	(3,6)	(4,6)	(5,6)	(6,6)	(7,6)	(8,6)	(9,6)
x_2	5	**(4,5)**	**(5,5)**	(3,5)	(4,5)	(5,5)	(6,5)	(7,5)	(8,5)	(9,5)
	4	**(6,4)**	**(5,4)**	(3,4)	(4,4)	(5,4)	(6,4)	(7,4)	(8,4)	(9,4)
	3	**(6,3)**	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)	(7,3)	(8,3)	(9,3)
	2	**(7,2)**	(2,2)	(3,2)	**(4,6)**	**(5,5)**	(6,4)	(7,2)	(8,2)	(9,2)
	1	(1,1)	**(2,7)**	**(3,6)**	**(4,5)**	**(5,4)**	(6,3)	(7,2)	(8,1)	(9,1)
		1	2	3	4	5	6	7	8	9
						x_1				

Note: Gray-highlighted messages are bad hands profitably lying (since they are accepted). Messages in bold are bad hands lying even though they are rejected.

value). The receiver accepts if and only if the observed value is 7+ (for T11) or 6+ (for T9) irrespective of the message.

This strategy combination leads to the GR outcome: all types with a 7+ (for T11) or 6+ (for T9) are accepted, and all other types are rejected.

To see that this is a sequential equilibrium, note that the strategy of the sender is a best response: all types with 7+ (6+) are accepted, while other types cannot be accepted given the receiver's strategy. As for the strategy of the receiver, it is a best response because, conditional on a 7+ (6+) value being observed, the type is more likely to be good than bad (and this is true irrespective of the message); conditional on a value under 7 (6) being observed, the type is more likely to be bad than good (again, irrespective of the message). For example, if T11 and if a 7 is observed, the other aspect may be any value between 1 and 7, with 7 itself being only half as likely; this results in a probability of $\frac{7}{13} > 0.5$ that the type is good, so it is optimal to accept as the strategy specifies. If a 6 is observed, the other aspect may be any value between 1 and 6, with 6 itself being half as likely; this results in a probability of $\frac{3}{11} < 0.5$ that the type is good, so it is optimal to reject as the strategy specifies. The case of T9 is similar, except that the acceptance threshold is lower since more types are good when T9. If a value of 6 is observed, it is (of course) still true that the other aspect may be any value between 1 and 6, with 6 itself being half as likely; this results in a probability of $\frac{7}{11} > 0.5$ that the type is good, so it is optimal to accept as the strategy specifies. If a value of 5 is observed, the other aspect may be any value between 1 and 5, with 5 itself being half as likely, and this results in a probability of $\frac{5}{11} < 0.5$ that the hand is good, hence it is optimal for the receiver to reject as the strategy specifies.

Note also that we have constructed the strategy of the sender in such a way that all combinations of messages and values are observed in equilibrium, so the receiver never knowingly encounters an off-equilibrium information set and the sequential equilibrium requirement does not bite. The sender's messaging strategy is already fully mixed, and a fully mixed revelation strategy can be constructed in such a way that the sender reveals the higher value with probability $1 - \varepsilon$ and the lower value with probability ε. The receiver's beliefs are such that the receiver places probability 1 on the higher of the two values being revealed.

D.2.2 *A sequential equilibrium leading to the GR outcome where the acceptance decision depends on the message*

The sender follows the message strategy in Table 2 (for T11) or Table D4 (in T9), and reveals the aspect with the higher value (revealing an aspect at random if both aspects have the same value). The receiver accepts if and only if a good type is reported and a 7+ aspect (in T11) or a 6+ aspect (in T9) is revealed.

In what follows we discuss the case of T11. The case of T9 is analogous (one just have to replace Table 2 with Table D4, and the 7+ cutoff value with 6+).

The sender's strategy is a best response to the receiver's strategy since all types with a 7+ are reporting a good type and revealing a 7+ aspect, ensuring acceptance. Other types cannot be accepted given the receiver's strategy.

Given the sender's strategy, there are combinations of messages and values observed that are never observed if the sender sticks to the strategy described. In order to have a sequential equilibrium, we need to construct an auxiliary sequence of strategies and beliefs as explained earlier.

Take the following sequence of fully mixed strategies for the sender. The sender follows the messaging strategy in Table 2) with probability $1 - \varepsilon - \varepsilon^2$. Senders with good types and a 7+ aspect send one of the 36 good type messages at random with probability ε; with probability ε^2 they send one of the 45 bad type messages at random. All other senders send one of the 45 bad type messages at random with probability ε and one of the 36 good type messages at random with probability ε^2.

As for the revelation strategy, all senders reveal the higher aspect with probability $1 - \varepsilon$ (and reveal one aspect at random if both values are equal).

A sequence of receiver beliefs is constructed from the sequence of sender beliefs using Bayes rule. The beliefs that we specify for the receiver are the limit of this sequence of beliefs, and the receiver strategy we have specified must be optimal given these beliefs.

For combinations of values and messages that are possible given Table 2), the receiver beliefs are derived from Table 2) itself (recall that $\varepsilon \to 0$, so for example if $(9, 2)$ is sent and a 9 is displayed, the receiver believes the type is equally likely to be $(9, 1)$ and $(9, 2)$); we have already established that the receiver acceptance strategy is optimal in these cases (see our earlier discussion for RV, where the sender also uses the message strategy in Table 2)).

As for other cases, receiver beliefs constructed as the limit of the sequence are such that, irrespective of what value is observed, the receiver believes that the aspect being observed is the higher of the two. This means that, using the information of the value observed only, a value of 6 or less suggests the type is more likely to be bad than good. The message does not change this conclusion since it contains no additional information as to whether the type is good or bad.

For types with a 7+ however, the receiver strategy is such that they are accepted if the reported type is good but rejected if the reported type is bad. Bad types with a 7+ aspect are disproportionately more likely to report a bad type in the sequence we constructed, and this justifies receiver's beliefs that a bad type message makes the type more likely to be bad than good even if a 7+ value is observed.

As in the corresponding equilibrium in RV, this equilibrium results in the finest equilibrium partition (see the earlier discussion in Appendix D.1.2).

Also similarly to RV, not all messaging strategies where the sender reports good types truthfully and inflates bad types with a 7+ aspect would induce a sequential equilibrium. In order for the receiver's strategy to be a best response to the sender's strategy, the sender cannot concentrate the lies on messages that add up to the bare minimum required to make up a good type, and, if all good types tell the truth, there must be bad types that send messages $(6,6)$, $(6,5)$ and $(5,6)$ even though there is no strict gain from doing so.[21]

[21]Because the sender chooses which aspect to reveal, bold messages in Table 2 other than (6,6), (6,5) and (5,6) could be changed to truthful messages without affecting the receiver's best response.

E OTHER EQUILIBRIUM EXAMPLES

E.1 *Receiver-Verifies*

E.1.1 *Receiver's worst equilibrium*

The receiver achieves their lowest possible equilibrium payoff when the message is uninformative (e.g. all sender types send each of the possible messages with equal probability, or all sender types send the same message). In such an equilibrium the receiver does not condition the checking decision on the message (e.g. the receiver always checks the same aspect, or checks each of the two aspects with equal probability), and, upon observing one of the aspects, takes the optimal acceptance decision given that the other aspect is equally likely to be any value between 1 and 9.

For T11, the optimal acceptance decision is to accept if and only if the observed aspect is 6 (since in 5/9 of cases the sum is at least 11) or higher. This equilibrium gives rise to a payoff of $\frac{61}{81}$ for the receiver and $\frac{36}{81}$ for the sender.

For T9, the optimal acceptance decision is to accept if and only if the observed aspect is 4 (since in 5/9 of cases the sum is at least 9) or higher. This equilibrium gives rise to a payoff of $\frac{62}{81}$ for the receiver and $\frac{54}{81}$ for the sender.

It is not possible for the receiver to obtain a lower expected payoff in equilibrium. This is because, given any sender message, the receiver can always ignore the message, check the first aspect and accept if and only if the observed value is 6+ (for T11) or 4+ (for T9). If, in equilibrium, the receiver does something different conditional on the received message, the receiver must be at least as well off as if she followed the above strategy.

E.1.2 *Sender's best equilibrium*

Table E1 below depicts the sender's message strategy in an equilibrium which gives the highest possible equilibrium payoff to the sender in RV11. The receiver's checking strategy is as follows. If message $(6, 1)$ or $(1, 6)$ is received, the receiver checks the claim of 6 (and checks at random if any other message is received). The acceptance strategy is to accept if and only if the observed value is 6+, irrespective of which claim was checked.

Table E1: Sender's best equilibrium strategy in RV11

x_2										
	9	1,6	1,6	1,6	1,6	1,6	1,6	6,1	6,1	6,1
	8	1,6	1,6	1,6	1,6	1,6	6,1	6,1	6,1	6,1
	7	1,6	1,6	1,6	1,6	1,6	6,1	1,6	1,6	1,6
	6	1,6	1,6	1,6	1,6	1,6	6,1	1,6	1,6	1,6
x_2	5	6,1	6,1	6,1	6,1	1,6	6,1	6,1	6,1	6,1
	4	6,1	6,1	6,1	6,1	1,6	6,1	6,1	6,1	6,1
	3	1,6	1,6	1,6	1,6	1,6	6,1	6,1	6,1	6,1
	2	1,6	1,6	1,6	1,6	1,6	6,1	6,1	6,1	6,1
	1	1,6	1,6	1,6	1,6	6,1	6,1	6,1	6,1	6,1
		1	2	3	4	5	6	7	8	9
						x_1				

Note that in this equilibrium the sender uses only two messages, (6,1) and (1,6). These messages are used, together with the checking strategy, to ensure that the receiver observes a 6+ aspect if there is one. The acceptance strategy then results in all senders with a 6+ aspect being accepted. The lower acceptance threshold (compared to the equilibrium discussed earlier that results in the GR outcome) is made possible by the strategy of the sender, which does not necessarily point to the higher of the two aspects when both aspects are 6+.

The sender is clearly playing a best response to the receiver's strategy, since the receiver accepts only after observing a 6+ aspect and the sender's strategy leads to all types with a 6+ being accepted.

The receiver's strategy can be divided into acceptance strategy and checking strategy. It is tedious but straightforward to check that the receiver is playing a best response to the sender. For example, suppose the message is $(6,1)$, the receiver checks the first aspect (as required by the strategy) and observes a value of 6. Given the sender's strategy in the table, this means that the type is equally likely to be any of the types where $x_1 = 6$ and $x_2 < 9$; since four out of eight such types are good types it is indeed optimal for the receiver to accept. As for the checking strategy, conditional on message $(6,1)$ or $(1,6)$ being received and on the receiver's acceptance strategy, the receiver is making 20 errors (all consisting of accepting bad types). Can the receiver do better by checking the other aspect? Suppose the message is $(6,1)$. If the receiver checks the first aspect and accepts if the observed value is 6+, the receiver is making 10 errors (accepting $(6,4)$, $(6,3)$, $(6,2)$, $(6,1)$, $(7,3)$, (7,2), (7,1), (8,2), (8,1) and (9,1)). If the receiver checks the second aspect instead, it is still optimal to accept if the observed aspect is 6+ and to reject otherwise, and the receiver would still make 10 errors (rejecting the good types that send the message (6,1) and have $x_2 < 6$, namely (6,5), (7,5), (8,5), (9,5), (7,4), (8,4), (9,4), (8,3), (9,3) and (9,2)). Analogously, it can be checked that if (1,6) is sent but the receiver checks the first aspect, the receiver would still make at least 10 errors.

As for messages other than (6,1) and (1,6), we have specified that the receiver checks a claim at random and accepts if and only if a 6+ value is observed. Is this strategy part of a sequential equilibrium? Consider the following sequence of fully mixed strategies by the sender. The sender plays the messaging strategy described above with probability $1 - \varepsilon$, and sends one of the 81 messages at random with probability ε. If the receiver gets a message other than (1,6) or (6,1), the message is not informative and each of the 81 possible types is equally likely. It would then be optimal for the receiver to check either aspect and accept if and only if a 6+ value is observed.

In this equilibrium, all good types and 20 bad types are accepted. The only way the sender could obtain a higher payoff would be if another bad type was accepted, but this would bring the receiver's payoff below 61/81, which is the lower bound for the receiver's equilibrium payoff (see previous subsection).

The case T9 is analogous. Table E2 depicts the sender's message strategy in an equilibrium which gives the highest possible equilibrium payoff to the sender. The receiver's checking strategy is as follows. If message (4,1) or (1,4) is received, the receiver checks the claim of 4 (and checks at random if any other message is received). The acceptance strategy is to accept if and only if the observed value is 4+, irrespective of which claim was checked.

Given the sender's strategy, an acceptance threshold of 4 is optimal for the receiver. When message (4,1) is received, the receiver makes 10 errors by checking the first aspect (accepting types (7,1),(6,1), (6,2),(5,1),(5,2),(5,3),(4,1),(4,2),(4,3), and (4,4)). If the receiver checks the second aspect instead, they still make 10 errors (accepting (4,4), and rejecting the nine good hands that send message (4,1) and have $x_2 < 4$, namely (9,1),(9,2),(9,3),(8,1),(8,2),(8,3),(7,2),(7,3) and (6,3)). Similarly, if message (1,4) is received, the receiver makes 9 errors by checking the second aspect (accepting (7,1),(6,1),(6,2),(5,1),(5,2),(5,3),(4,1),(4,2) and (4,3)).

Table E2: Sender's best equilibrium strategy in RV9

x_2										
	9	1,4	1,4	1,4	4,1	4,1	4,1	4,1	4,1	4,1
	8	1,4	1,4	1,4	4,1	4,1	1,4	4,1	4,1	4,1
	7	1,4	1,4	1,4	4,1	1,4	4,1	4,1	4,1	4,1
	6	1,4	1,4	1,4	1,4	4,1	4,1	4,1	4,1	1,4
x_2	5	1,4	1,4	1,4	4,1	4,1	4,1	1,4	1,4	1,4
	4	1,4	1,4	1,4	4,1	4,1	4,1	1,4	1,4	1,4
	3	4,1	4,l	1,4	4,1	4,1	4,1	4,1	4,1	4,1
	2	1,4	1,4	1,4	4,1	4,1	4,1	4,1	4,1	4,1
	1	1,4	1,4	4,1	4,1	4,1	4,1	4,1	4,1	4,1
		1	2	3	4	5	6	7	8	9
						x_1				

Checking the first aspect instead would lead to 9 errors, all consisting of rejecting good hands that send message $(1, 4)$ and have $x_1 < 4$.

In this equilibrium, all good types and 19 bad types are accepted. The only way the sender could obtain a higher payoff would be if another bad type was accepted, but this would bring the receiver's payoff below 62/81, which is the lower bound for the receiver's equilibrium payoff in RV9 (see previous subsection).

E.2 *Sender-Reveals*

E.2.1 *Receiver's worst equilibrium*

For both parametrizations, the receiver's worst equilibrium results in the same action and payoffs as the receiver following the prior, as we show below. Hence, neither messages nor evidence help the receiver in the worst equilibrium.

We now describe an equilibrium that attains the receiver's lowest equilibrium payoff for SR11. In this equilibrium the sender sends a random message and reveals the highest aspect for bad types and the lower one for good types (when the two aspects are equal, one is revealed at random). The receiver rejects irrespective of the observed value and of the message.

To see that this is an equilibrium, we note that given the sender's strategy, the probability of the type being good is lower than 0.5 for any combination of message and value observed. For example, suppose the sender reveals that the first aspect is a 9. Given the sender's strategy, there are only two types that reveal the first aspect when its value is a 9: (9,1) and (9,9). Because (9,9) reveals the first aspect with probability 0.5, while (9,1) always reveals the 9, the probability of a good type conditional on observing the first aspect to be a 9 is $\frac{1}{3}$ which is less than 0.5. Hence, the receiver best replies by always rejecting.

This equilibrium gives rise to a payoff of $\frac{45}{81}$ for the receiver and 0 for the sender. This is the receiver's lowest possible equilibrium payoff since the receiver always has the option to reject for any given message and evidence, and this would lead to a payoff of $\frac{45}{81}$.

For T9, an equilibrium that leads to the receiver's lowest equilibrium payoff is as follows. The sender sends a random message and reveals the highest aspect for bad types and the lower one for good types (when the two aspects are equal, one is revealed at random). The receiver accepts irrespective of the observed value and of the message.

Given the sender's strategy, the probability of the type being good is higher than 0.5 for any combination of message and value observed, hence it is optimal for the receiver to accept. For example, suppose the sender reveals that the first aspect is a 1. Given the sender's strategy, there are three types that reveal the first aspect when its value is a 1: (1,8) and (1,9) and (1,1), the latter with probability 0.5. The probability of a good type conditional on observing the first aspect to be a 1 is $\frac{4}{5}$ which is more than 0.5.

This equilibrium gives rise to a payoff of $\frac{53}{81}$ for the receiver and 1 for the sender. This is the receiver's lowest possible equilibrium payoff since the receiver always has the option to accept for any given message and evidence.

For an equilibrium where both the sender and the receiver are worse-off compared to the GR equilibrium in SR9, suppose the sender sends a random message and reveals an 8+ value if available. If both cards are below 8, bad sender types reveal their higher aspect, while good sender types reveal their lower aspect. The receiver then accepts if 8+ is observed and rejects otherwise. This equilibrium leads to a payoff of 32/81 for the sender and 70/81 for the receiver. It is the worst possible equilibrium for the sender since senders with an 8+ aspect must be accepted in any equilibrium (no receiver beliefs justify rejection) and no other sender types are accepted.

E.2.2 *Sender's best equilibrium*

For T9, the sender's best equilibrium coincides with the receiver's worst equilibrium described above. This is because the receiver always accepts in this equilibrium, just as in the absence of messages or evidence.

For T11, the sender's best equilibrium is as follows. The sender sends a random message and reveals the lower aspect for types with two 6+ aspects and the higher aspect for all other types. The receiver's strategy is to accept if and only if the observed aspect is a 6+.

To see that this is an equilibrium, we note that given the sender's strategy, the probability of the type being good conditional on the observed aspect is higher than 0.5 as long as the observed aspect is a 6+, and equal to 0 otherwise. This makes it optimal for the receiver to accept if and only if she observes a 6+. In this equilibrium, the receiver obtains a payoff of $\frac{61}{81}$ while the sender gets $\frac{56}{81}$.

This is the best equilibrium for the sender because values of 1 to 5 of either aspect must be rejected in any sequential equilibrium, so the best the sender can achieve is to be accepted if he has a 6+ aspect. [22]

Note that all good hands are accepted in the sender's best equilibrium for both parametrizations, hence this equilibrium also maximizes the sum of sender's and receiver's payoffs.

F RV9 VS SR9 SUMMARY OF RESULTS

F.1 *Decisions*

The results from the T9 treatments are broadly consistent with those from the T11 treatments. First, we note that senders' reporting strategies are in line with Result 7: for bad hands with a 6+ card, senders in SR9 report a good hand while keeping the

[22] The proof is recursive. Start by noting that a value of 1 of either aspect must be rejected since it is certain to be a bad type. Types with an aspect above 1 will then display the other aspect if the other aspect has a positive probability of acceptance. This can then be used to prove (by contradiction) that a value of 2 of either aspect must be rejected with certainty, and so on. The recursion continues up to the value of 5.

highest of the two claims truthful in 85% of the cases, while in RV9 this happens only in 53% of cases which is significantly lower ($p - value = 0.016$). Second, consistent with Result 8, senders reveal the higher card more often in SR9 (98.56%) than receivers verify the higher claim in RV9 (82.64%), and this difference is statistically significant ($p - value < 0.001$). Third, when checking the frequency of observing a 6+ card for hands that include exactly one such value, we find that this frequency is equal to 99% in SR9 which is significantly higher than the 81% frequency observed in RV9 ($p - value = 0.008$). This is in line with Result 9. Fourth, compatible with Result 10, acceptance rates conditional on the observed value are significantly higher in RV9 than in SR9 for intermediate observed values ($p - value = 0.008$ for each value from 3 to 6). With respect to the main drivers of the acceptance decision across treatments, as in RV11 and SR11 (Result 11), we find that in RV9 receivers' likelihood to accept is strongly and most notably reduced by observing a misreport, while in SR9, it is mostly influenced by the value of the observed card (see Table F1).

Table F1: Probit analysis of acceptance decision in RV9 and SR9

	Dependent variable:	
	Acceptance Decision	
	(RV9)	(SR9)
Value of observed card	0.057***	0.147***
	(0.014)	(0.014)
Value of unverified claim	0.022***	0.023
	(0.001)	(0.013)
Misreport observed	−0.751***	−0.027
	(0.129)	(0.321)
Observed card = orange	−0.015	0.009
	(0.008)	(0.024)
Hand = good	0.016***	0.010
	(0.002)	(0.043)
Claimed sum = 9	−0.101	−0.076***
	(0.066)	(0.027)
Female	0.006	−0.021
	(0.032)	(0.041)
Period FE	Yes	Yes
Group FE	Yes	Yes
Observations	1,228	1,214

Notes: The table presents marginal effects. Period and group fixed effects are not reported. Standard errors in parentheses are robust and clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01. The analysis excludes cases where the sum of the two reports was less than 9 (claimed bad hands).

With respect to the comparison with the GR outcome, we note that the proportion of GR outcomes in SR9 is equal to 86% which is higher than the 84% observed in RV9. This difference is not statistically significant though ($p - value = 0.172$).

To investigate this further, Table F2 reports acceptance rates for good and bad hands, distinguishing between hands that are accepted in the GR outcome and hands that are rejected in the GR outcome. Note that, as in T11, the receiver prefers SR9 for bad hands with no high card, and RV9 in all other cases. However, in T11, 41% of hands were in the first category, while in T9 there are only 28% such hands. As a result, the receiver is marginally better-off in RV9 than in SR9.

Table F2: Acceptance rates for good and bad hands conditional on the value of the highest card (T9)

			Acceptance rate		
Type of hand		obs.	SR9	RV9	$p-$ value
Highest card < 6	Bad hands	365	0.173	0.211	0.156
	Good Hands	57	0.509	0.754	0.031
	All hands	422	0.218	0.284	0.039
Highest card ≥ 6	Bad Hands	86	0.721	0.430	0.031
	Good hands	812	0.911	0.948	0.234
	All hands	898	0.893	0.899	0.461

F.2 *Best-response analysis*

The results from analyzing the receiver's best response to the observed sender behavior in T9 are also consistent with the results reported for T11. Recall that, for SR9, we restrict attention to strategies that condition on the observed value and the claim about the other card. If the receiver makes the optimal decision for each combination of observed value and unverified claim, the receiver's expected payoff is 0.896, which we refer to as the empirical optimum. Analogously to Result 13, following the optimal commitment strategy that accepts if and only if a good hand is reported and a 6+ value is observed would give the receiver 99.88% of the empirical optimum. Similarly, for RV9, behaving optimally for all senders' messages gives the receiver an average payoff of 0.882. Analogously to Result 14, following the optimal commitment strategy of checking the higher message and accepting if and only if no misreport is observed, a good hand is claimed and the observed value is 6+, gives the receiver 99.77% of the empirical optimum.

G BEST RESPONSE ANALYSIS - FURTHER DETAILS

G.1 *Baseline*

The empirical best response in BASE is to accept if at least 50% of hands given a message are good, and reject otherwise. We present the corresponding frequencies in the following tables.

Table G1: Proportion of good hands given message in BASE11

Reported value on other card	Reported value on one card: 1	2	3	4	5	6	7	8	9
1	0%	0%	0%	33%	50%	14%	29%	33%	30%
2		0%	0%	20%	33%	13%	0%	0%	37%
3			0%	0%	17%	22%	0%	43%	53%
4				0%	25%	25%	38%	45%	51%
5					50%	42%	33%	44%	61%
6						43%	34%	46%	63%
7							52%	52%	68%
8								46%	61%
9									42%

Note: Highlighted cells represent cases where accepting yields an expected payoff of at least 50%.

Table G2: Proportion of good hands given message in BASE9

Reported value on other card	Reported value on one card: 1	2	3	4	5	6	7	8	9
1	0%	0%	0%	0%	0%	25%	33%	73%	78%
2		0%	0%	0%	10%	14%	49%	70%	82%
3			0%	0%	0%	56%	47%	71%	77%
4				NA	61%	58%	57%	70%	81%
5					77%	60%	74%	77%	87%
6						76%	72%	85%	71%
7							88%	77%	89%
8								70%	94%
9									86%

Note: Highlighted cells represent cases where accepting yields an expected payoff of at least 50%.

G.2 *Sender-Reveals*

In the SR11 game, like in BASE11, the receiver only has an acceptance decision to make. However, the information available to the receiver is richer, as it now consists of the revealed value and the sender's message. To identify an optimal benchmark, we allow the sender to condition on the revealed value and the claim about the other card.[23] Table G3 presents the proportion of good hands conditional on the revealed value and the unverified claim. If this proportion is greater than 50%, it is optimal for the receiver to accept, and these cells are highlighted (when the proportion of good hands is equal to 50%, any decision is a best response). We refer to the strategy of making the optimal decision for each combination of revealed value and unverified claim as the empirical best response. The resulting expected payoff is 0.827, and we refer to this as the empirical optimum.

Table G3: Proportion of good hands given revealed value and unverified claim

		Revealed Value								
		1	2	3	4	5	6	7	8	9
Unverified Claim	1	0%	0%	0%	0%	11%	0%	50%	33%	0%
	2	0%	0%	0%	0%	0%	0%	0%	0%	78%
	3	0%	0%	0%	0%	0%	0%	0%	55%	88%
	4	0%	0%	0%	0%	0%	0%	49%	52%	75%
	5	0%	0%	0%	0%	0%	27%	43%	74%	89%
	6	0%	NA	0%	0%	0%	32%	74%	86%	98%
	7	0%	0%	0%	0%	4%	50%	63%	88%	100%
	8	NA	0%	10%	0%	10%	20%	67%	75%	100%
	9	0%	3%	0%	0%	0%	0%	50%	100%	100%

Note: Highlighted cells represent the cases where accepting yields an expected payoff above 50%.

In Table G4 we present receiver's expected payoff from alternative strategies to understand how they compare with the empirical best response.

[23] Thus, we ignore the claim about the revealed value. This does not affect the conclusions of our analysis because misreports of the revealed value are rare (less than 5% of cases) and, when a misreport is revealed, the optimal decision would be reached in over 95% of cases without using this information.

Table G4: Receiver's expected payoff given observed sender behavior in SR11

Strategy	Payoff
Empirical Best Response	0.827
Ignore message and evidence	
- - - accept or reject at random	0.500
- - - always reject	0.562
Ignore message	
accept iff	
- - - $x_k \geq 8$	0.794
- - - $x_k \geq 7$	0.810
- - - $x_k \geq 6$	0.750
Use message for acceptance decision	
accept iff reported sum ≥ 11 &	
- - - $x_k \geq 8$	0.800
- - - $x_k \geq 7$	0.822
- - - $x_k \geq 6$	0.768

G.3 *Receiver-Verifies*

Given the actual sender behavior in the RV11 treatment, should the receiver check the card corresponding to the highest or to the lowest claim? Moreover, should she pay attention to the unverified claim? Lastly, which values should the receiver accept? First, if the sender reports a bad hand, the hand is almost certainly bad (only 1 out of 198 reported bad hands is good). In this case, it is optimal to reject independent of which card is checked and whether the check reveals a truthful claim or a lie.

What about the hands that are reported as good? In Table G5 we present the payoffs corresponding to each checking and acceptance decision for all messages representing reported good hands. We see that checking the highest claim and accepting if this is true is the better choice for most messages since it leads to a higher expected payoff. Why is it better for the receiver to accept only if the checked claim turns out to be true? This is because the vast majority of discovered misreports (i.e. 89.76%) represent bad hands.

Table G5: Receiver's best response to sender messages in RV11

Message[24]	Absolute frequency of message	Absolute frequency of good hands given message	Expected payoff from: check highest claim & accept if true[25]	Expected payoff from: check lowest claim & accept if true[26]	Expected payoff from: check either claim & always reject[27]	Expected payoff from: check either claim & always accept[28]
(9,9)	55	32	0.773	0.773	0.418	0.582
(9,8)	40	35	0.900	0.900	0.125	0.875
(9,7)	45	38	0.978	0.933	0.156	0.844
(9,6)	36	34	0.972	0.944	0.056	0.944
(9,5)	55	45	0.909	0.945	0.182	0.818
(9,4)	29	24	0.966	0.862	0.172	0.828
(9,3)	55	35	0.800	0.836	0.364	0.636
(9,2)	73	23	0.932	0.438	0.685	0.315
(8,8)	31	22	0.726	0.726	0.290	0.710
(8,7)	40	29	0.850	0.850	0.275	0.725
(8,6)	51	40	0.941	0.843	0.216	0.784
(8,5)	52	37	0.885	0.827	0.288	0.712
(8,4)	69	27	0.739	0.681	0.609	0.391
(8,3)	117	32	0.786	0.496	0.726	0.274
(7,7)	47	24	0.872	0.872	0.489	0.511
(7,6)	41	31	0.902	0.927	0.244	0.756
(7,5)	81	30	0.691	0.704	0.630	0.370
(7,4)	129	38	0.798	0.527	0.705	0.295
(6,6)	56	25	0.696	0.696	0.554	0.446
(6,5)	140	30	0.586	0.621	0.786	0.214

Note: Highlighted cells represent receiver's optimal payoff for a given message.

[24]Each message gives the highest claim first and ignores whether this claim refers to the blue or orange card.

[25]Computed by counting the instances in which the highest claim is untrue and the hand is bad and those where the highest claim is true and the hand is good. This is then divided by the frequency of the corresponding message.

[26]Computed by counting the instances in which the lowest claim is untrue and the hand is bad and those where the lowest claim is true and the hand is good. This is then divided by the frequency of the corresponding message.

[27]Computed by counting the number of bad hands and then dividing by the frequency of the corresponding message.

[28]Computed by counting the number of good hands and then dividing by the frequency of the corresponding message.

Next, the receiver should check the highest claim as this claim is more likely to be false. Since a misreport is very often a bad hand, checking the highest claim allows the receiver to take as many bad hands out of the sample as possible by rejecting. This also increases the probability that the hand is good conditional on the claim being true and reduces the number of errors in case of acceptance. In cases where this probability is less than 50% for both claims, it is optimal to reject all hands and which claim is checked is immaterial. This is the case of the (6,5) message when the receiver is better off rejecting even if the observed value is as reported. Table G6 presents receiver's expected payoff from alternative strategies given the observed sender behavior.

Table G6: Receiver's expected payoff given observed sender behavior in RV11

Strategy	Payoff
Empirical Best Response	0.853
Ignore message	
accept or reject at random	0.500
always reject	0.562
check at random & accept iff:	
- - - $x_k \geq 7$	0.740
- - - $x_k \geq 6$	0.752
- - - $x_k \geq 5$	0.740
Use message for acceptance decision only	
check at random & accept iff:	
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ (fair random)	0.792
Use message for checking decision only	
check lower claim & accept iff:	
- - - $x_k \geq 6$	0.731
- - - $x_k \geq 5$	0.758
- - - $x_k \geq 4$	0.730
check higher claim & accept iff:	
- - - $x_k \geq 8$	0.796
- - - $x_k \geq 7$	0.817
- - - $x_k \geq 6$	0.772
Use message for checking and acceptance decision	
check lower claim & accept iff:	
- - - $m_k = x_k$ & $m_i + m_j \geq 11$	0.753
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ & $x_k \geq 5$	0.765
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ & $x_k \geq 4$	0.766
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ & $x_k \geq 3$	0.765
check higher claim & accept iff:	
- - - $m_k = x_k$ & $m_i + m_j \geq 11$	0.831
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ & $x_k \geq 8$	0.802
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ & $x_k \geq 7$	0.848
- - - $m_k = x_k$ & $m_i + m_j \geq 11$ & $x_k \geq 6$	0.831

ONLINE APPENDIX

OA.A INSTRUCTIONS

OA.A.1 *RV11*

INSTRUCTIONS

Welcome and thank you for participating in this experiment. Throughout the whole experiment you are kindly asked to remain seated and refrain from communication with the other participants. Mobile phones and other electronic devices should be switched off. If there are any questions please raise your hand and an experimenter will come to answer your questions in private.

Payment: This experiment consists of 30 rounds. In each round you can earn points. At the end of the experiment you will be paid according to your accumulated point-earnings from all rounds. You will be paid in private and in cash with **£0.50 for each point earned**. Additionally, you will receive a **participation fee of £3.**

All your decisions are anonymous, so your identity will be kept secret at all times.

At the beginning of each round you will be randomly matched with another participant (i.e. the person you are paired with will change from round to round). One of you will have the role of Person A and the other the role of Person B. Your role will be assigned at the beginning of the first round and you will keep this role for all 30 rounds.

Each round consists of 2 stages which are described below.

Stage 1: *Person A observes two cards and sends a message*

In this stage, the computer will randomly select two cards, one **orange** and one **blue**, each carrying a value between 1 and 9. Each combination of values on these 2 cards is equally probable. At this stage, only **Person A** will be able to observe these values.

The hand is "**GOOD"** if the sum of the values on the two cards is **at least 11**. The hand is "**BAD**" if the sum of the values is **10 or below**.

This is an example of a BAD hand:

After observing the randomly drawn cards, Person A will send a message to Person B of the following form:

The value of the **orange card** is: [ ]

The value of the **blue card** is: [ ]

where Person A fills each blank box with a number between 1 and 9.

Stage 2: *Person B selects one of the cards to observe and makes a decision*

After observing Person A's message, Person B will **select one of the two cards** (**orange** or **blue**) and the computer will reveal its value.

After observing the value on the selected card Person B will **decide between "Accept" and "Reject"**.

End of the Round

At the end of the round both Person A and Person B will receive a summary of the round including:

- The cards that were randomly dealt;
- Person A's message;
- Person B's choice regarding which card to observe;
- Person B's decision to accept or reject;
- Person A and Person B's point-earnings for the round.

How your point earnings are determined:

Person A earns 1 point if B accepts and 0 points if B rejects.

Person B earns 1 point if A has a good hand and B accepts or if A has a bad hand and B rejects. Person B earns 0 points otherwise.

This is summarised in the Table below:

	B **Accepts**	B **Rejects**
A has a **GOOD** hand	Person A receives 1 point, Person B receives 1 point	Person A receives 0 points, Person B receives 0 points
A has a **BAD** hand	Person A receives 1 point, Person B receives 0 points	Person A receives 0 points, Person B receives 1 point

Preliminary questions: Before the 30 rounds begin, you will be asked to answer a few questions regarding your understanding of the instructions. The rounds will begin only after all participants have answered these questions correctly.

Final questionnaire: After the 30 rounds, you will be asked to fill in a short questionnaire. You will then be paid your earnings in private and in cash.

OA.A.2 *SR11*

INSTRUCTIONS

Welcome and thank you for participating in this experiment. Throughout the whole experiment you are kindly asked to remain seated and refrain from communication with the other participants. Mobile phones and other electronic devices should be switched off. If there are any questions please raise your hand and an experimenter will come to answer your questions in private.

Payment: This experiment consists of 30 rounds. In each round you can earn points. At the end of the experiment you will be paid according to your accumulated point-earnings from all rounds. You will be paid in private and in cash with **£0.50 for each point earned**. Additionally, you will receive a **participation fee of £3.**

All your decisions are anonymous, so your identity will be kept secret at all times.

At the beginning of each round you will be randomly matched with another participant (i.e. the person you are paired with will change from round to round). One of you will have the role of Person A and the other the role of Person B. Your role will be assigned at the beginning of the first round and you will keep this role for all 30 rounds.

Each round consists of 3 stages which are described below.

Stage 1: *Person A observes two cards and sends a message*

In this stage, the computer will randomly select two cards, one **orange** and one **blue**, each carrying a value between 1 and 9. Each combination of values on these 2 cards is equally probable. At this stage, only **Person A** will be able to observe these values.

The hand is "**GOOD"** if the sum of the values on the two cards is **at least 11**. The hand is "**BAD**" if the sum of the values is **10 or below**.

This is an example of a BAD hand:

After observing the randomly drawn cards, Person A will send a message to Person B of the following form:

The value of the **orange card** is: ☐

The value of the **blue card** is: ☐

where Person A fills each blank box with a number between 1 and 9.

Stage 2: *Person A selects one of the cards for Person B to observe*

After Person B observes Person A's message, Person A will **select one of the two cards** (**orange** or **blue**) for Person B to observe its value in the next stage.

Stage 3: *Person B observes the value of the card and makes a decision*

After observing the value of the selected card, Person B will **decide between "Accept" and "Reject"**.

End of the Round

At the end of the round both Person A and Person B will receive a summary of the round including:

- The cards that were randomly dealt;
- Person A's message;
- Person A's choice regarding which card to be observed by Person B;
- Person B's decision to accept or reject;
- Person A and Person B's point-earnings for the round.

How your point earnings are determined:

Person A earns 1 point if B accepts and 0 points if B rejects.

Person B earns 1 point if A has a good hand and B accepts or if A has a bad hand and B rejects. Person B earns 0 points otherwise.

This is summarised in the Table below:

	B **Accepts**	B **Rejects**
A has a **GOOD** hand	Person A receives 1 point, Person B receives 1 point	Person A receives 0 points, Person B receives 0 points
A has a **BAD** hand	Person A receives 1 point, Person B receives 0 points	Person A receives 0 points, Person B receives 1 point

Preliminary questions: Before the 30 rounds begin, you will be asked to answer a few questions regarding your understanding of the instructions. The rounds will begin only after all participants have answered these questions correctly.

Final questionnaire: After the 30 rounds, you will be asked to fill in a short questionnaire. You will then be paid your earnings in private and in cash.

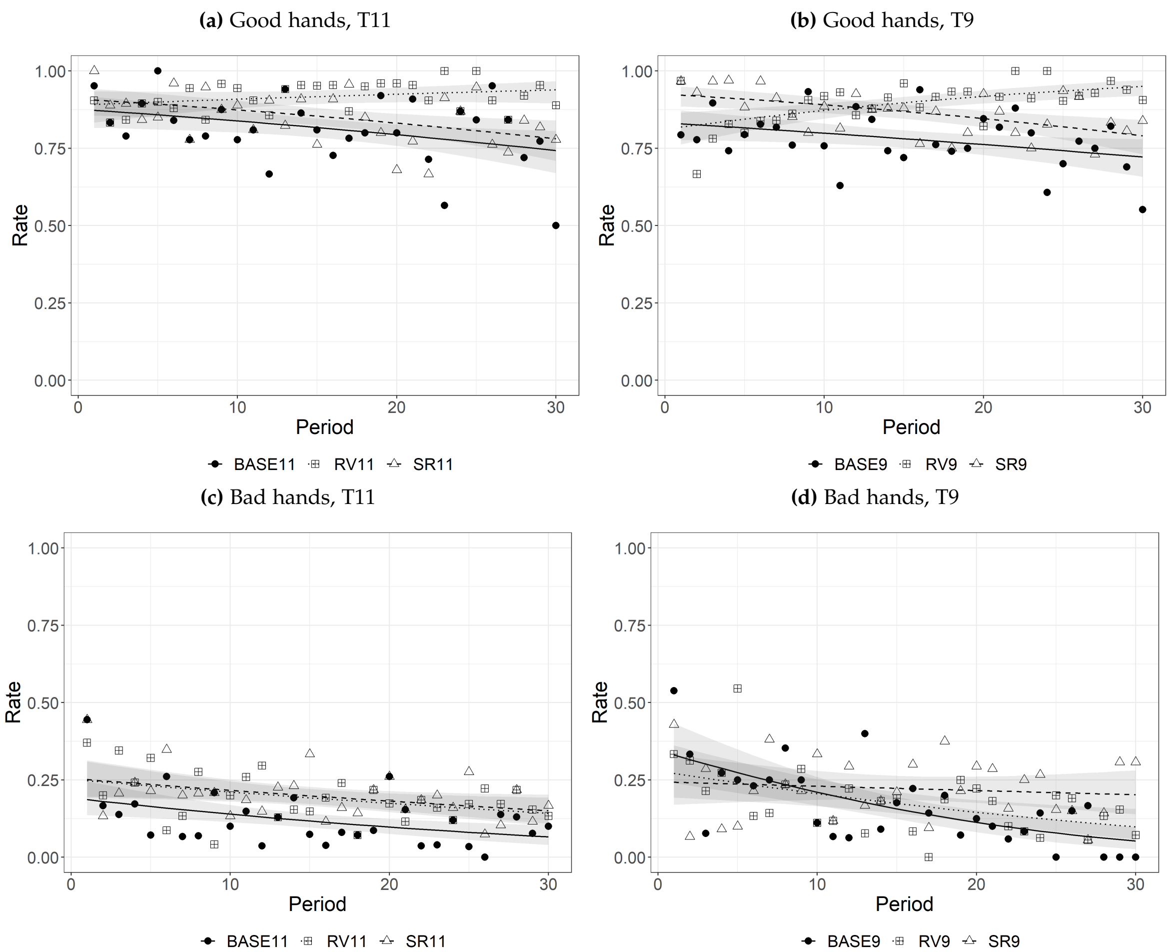
OA.B DYNAMICS

In this section we investigate whether subjects' decisions change across periods, and show that the results reported in the main text are robust to period effects.

OA.B.1 *Messages*

We first look at the rate of truthful reporting. Figure OA.B.1 shows the average truth-telling rate for good and bad hands in each treatment.

Figure OA.B.1: Truth-telling rates across periods



Note: The lines represent predicted rates from probit regressions (standard errors clustered at the matching group level).

Panels (a) and (b) suggests a small downward trend in truth-telling for good hands in SR and BASE, a stable dynamic in RV11, and a slightly increasing trend in RV9. Panels (c) and (d) suggest a small downward trend in truth-telling for bad hands in all treatments of T11, while in T9, this is only the case for BASE and RV.

Table OA.B.1 presents the marginal effects from a probit regression of whether the sender's message is truthful on the SR and RV treatment dummies, and variables for the interaction between period and each treatment.[29] This analysis is performed separately for good and bad hands. For good hands, the results show that the probability that the sender tells the truth is stable in RV11, increases significantly in RV9 and decreases significantly in all other treatments. For bad hands, the probability that the sender tells the truth decreases significantly over periods in all treatments, except for SR9 where no significant trend is detected. Note, however, that the estimated effects are quite small.

Table OA.B.1: Probit analysis of truth-telling rate

	Dependent variable: Truth-telling decision			
	T11		T9	
	(Good hands)	(Bad hands)	(Good hands)	(Bad hands)
(1) Treatment = SR	0.037	0.055^{**}	0.095^{*}	-0.063^{**}
	(0.023)	(0.022)	(0.052)	(0.025)
(2) Treatment = RV	0.015	0.052	-0.021	-0.041
	(0.024)	(0.037)	(0.051)	(0.055)
(3) Period x (Treatment = SR)	-0.004^{***}	-0.003^{***}	-0.004^{*}	-0.002^{***}
	(0.001)	(0.001)	(0.002)	(0.000)
(4) Period x (Treatment = RV)	0.002^{***}	-0.003^{*}	0.005^{***}	-0.006^{*}
	(0.000)	(0.002)	(0.001)	(0.003)
(5) Period x (Treatment = BASE)	-0.004	-0.005^{***}	-0.003^{***}	-0.011^{***}
	(0.003)	(0.001)	(0.000)	(0.002)
Observations	1,893	2,427	2,496	1,284
χ^2 for (1) = (2) = 0 & (3) = (4)	$> 4000^{***}$ (df=3)	7.584^{*} (df=3)	14.779^{**} (df=3)	1970^{***} (df=3)
χ^2 for (1) = (2) = 0 & (3) = (4) = (5)	$> 4000^{***}$ (df=4)	$> 4000^{***}$ (df=4)	$> 4000^{***}$ (df=4)	$> 4000^{***}$ (df=4)

Note: The table presents marginal effects; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

How do these dynamics affect the robustness of the results related to the messages sent by senders across treatments? In terms of the effect of evidence on the likelihood of reporting bad hands as good (Result 5), we find that there is a decreasing trend in truth-telling rates over periods in all treatments, with a slightly higher rate in the BASE treatments compared to the SR and RV ones. Does this change the

[29] This specification allows us to directly observe if the three treatments have significant, and potentially different period trends. In addition, using the Wald test, we can check if a treatment effect is present while controlling for period effects by testing the joint hypothesis that the coefficient on the treatment dummies are equal to 0 while the coefficients of the interaction terms are not different from each other. We compare separately the trends for SR with RV, and that of BASE with SR and RV. We report the associated χ^2 statistic in all regression tables.

fact that such reports are more likely to add up to T in the SR and RV treatments than in the BASE ones (Result 6)? Table OA.B.2 presents the marginal effects from a probit regression of whether the reported bad hand is equal to T on the SR and RV treatment dummies, and variables for the interaction between period and each treatment. We notice a decreasing trend in this likelihood across all treatments, however, the rate of decrease is approximately double in the BASE treatments than when messages are partially verifiable, suggesting that the effect we note in Result 6 is strengthened with experience.

Table OA.B.2: Probit analysis of rate of reporting bad hands as equal to T

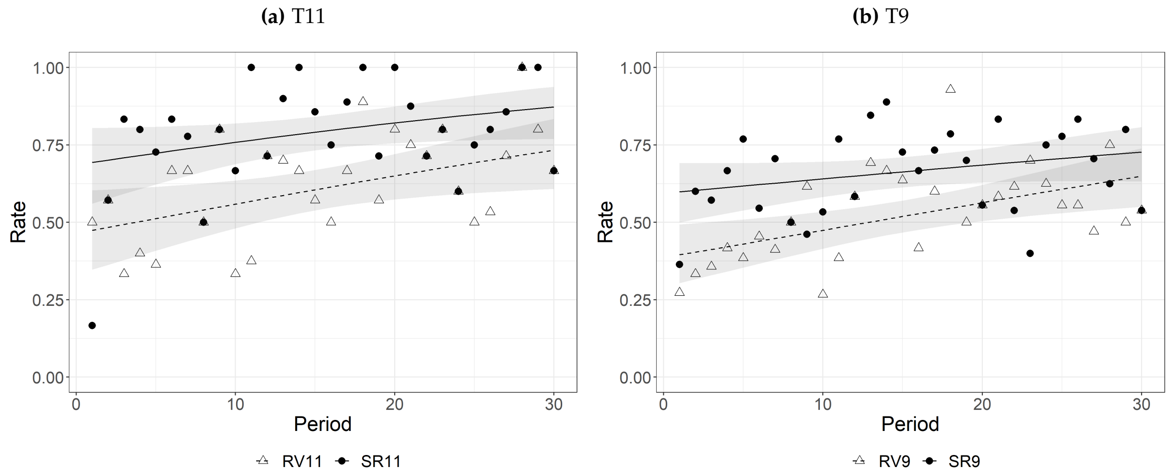
	Dependent variable:	
	Report bad hand as equal to T	
	(T11)	(T9)
(1) Treatment = SR	0.055^{**}	-0.063^{**}
	(0.022)	(0.202)
(2) Treatment = RV	0.052	−0.041
	(0.037)	(0.205)
(3) Period x (Treatment = SR)	-0.003^{***}	-0.002^{***}
	(0.001)	(0.007)
(4) Period x (Treatment = RV)	-0.003^{*}	-0.006^{*}
	(0.002)	(0.007)
(5) Period x (Treatment = BASE)	-0.005^{***}	-0.011^{***}
	(0.001)	(0.009)
Observations	2,427	1,284
χ^2 for (3) = (4) = (5)	293^{***} (df=2)	$> 4000^{***}$ (df=2)

Note: The table presents marginal effects; data includes only bad hands; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

We next look at the results regarding the effect of verification control on messages. Recall, Result 7 states that senders with a bad hand and a 7+ card usually inflate the value of the lower card while keeping the higher claim truthful, but are significantly more likely to do this in SR11 compared to RV11. We find a similar result in T9. Focusing on bad hands with one 7+ card for T11 and one 6+ card for T9, Figure OA.B.2 shows the rates of reporting a good hand while keeping the higher message truthful across treatments and periods.

The rates show a similar increasing trend in all treatments, but, except for very few periods across T11 and T9, the average rate in every period is at least as high in SR11 as in RV11 and in SR9 as in RV9. Table OA.B.3 presents the results from a probit analysis of the senders' likelihood of reporting a bad hand with one 7+ (6+) card as good while keeping the higher claim truthful. The regression results confirm that the difference between SR and RV is maintained when controlling for this increasing trend irrespective of the value of T.

Figure OA.B.2: Rates of reporting a good hand while keeping the higher message truthful across periods. (bad hands with one 7+ (6+) card.)



Note: The lines represent predicted rates from probit regressions (standard errors clustered at the matching group level).

Table OA.B.3: Probit analysis of the rate of reporting a good hand while keeping the higher claim truthful

	Dependent variable:	
	Good hand claimed & higher claim truthful	
	(T11)	(T9)
(1) Treatment = SR	0.195***	0.202***
	(0.043)	(0.020)
(2) Period x (Treatment = SR)	0.008***	0.005***
	(0.001)	(0.001)
(3) Period x (Treatment = RV)	0.008***	0.009***
	(0.008)	(0.007)
Observations	436	730
χ^2 for (1) = 0 & (2) = (3)	19.213*** (df=2)	370.6*** (df=2)

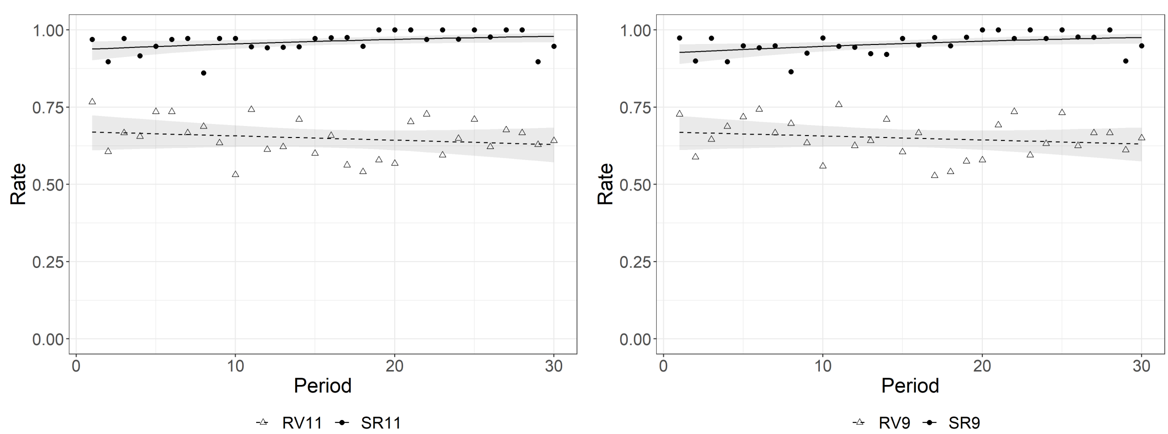
Note: The table presents marginal effects; data includes only bad hands with a 7+ card; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

OA.B.2 *Revelation/verification*

Our main result concerning the revelation/verification decision is that senders are more likely to reveal their higher card in SR than receivers are to check the higher claim in RV. Figure OA.B.3 shows the average rates of revealing the higher card in SR11 and SR9 and verifying the higher claim in RV11 and RV9 across periods. The rate in SR11 and SR9 is above 85% in every period following a slight increasing trend, while that in RV11 and RV9 is below 80% in every period following a slight decreasing trend. A probit regression (see Table OA.B.4) shows that the trend in SR11 and SR9 is significant while that in RV11 and RV9 is insignificant. Overall, the treatment difference remains high and strongly significant after controlling for period effects.

Figure OA.B.3: Rates of revealing the higher card / verifying the higher claim across periods. (Hands with non-equal cards/reports).

(a) T11 **(b)** T9



Note: The lines represent predicted rates from probit regressions (standard errors clustered at the matching group level).

Table OA.B.4: Probit analysis of the rate of revealing/verifying the higher card/claim

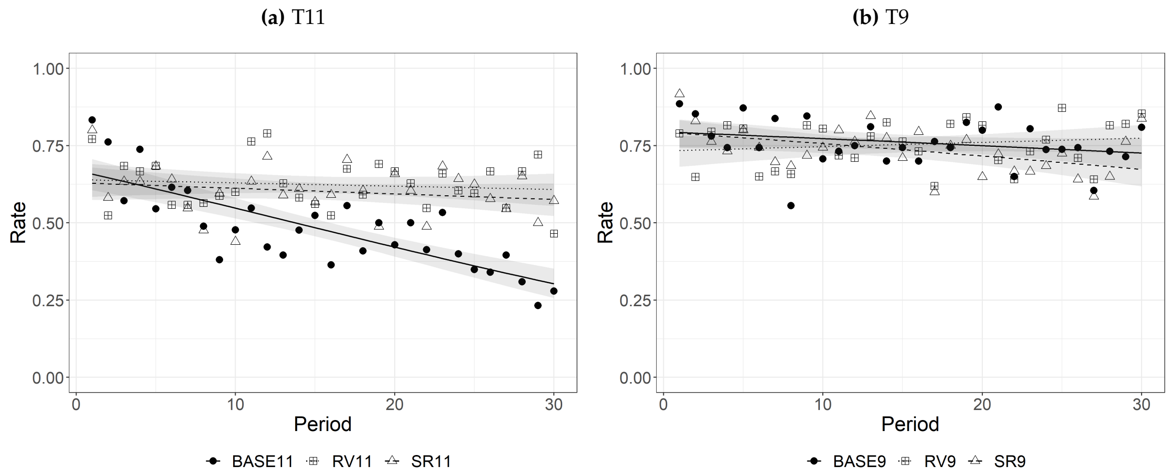
	Dependent variable:	
	Reveal/verify higher card/claim	
	(T11)	(T9)
(1) Treatment = SR	0.239***	0.229***
	(0.065)	(0.067)
(2) Period x (Treatment = SR)	0.004***	0.004***
	(0.000)	(0.001)
(3) Period x (Treatment = RV)	−0.001	−0.001
	(0.001)	(0.015)
Observations	2,167	2,265
χ^2 for (1) = 0 & (2) = (3)	166.02*** (df=2)	> 4000*** (df=2)

Note: The table presents marginal effects; data for SR excludes hands where the two cards were equal, while for RV, it excludes hands where the two reports were equal; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

OA.B.3 *Acceptance*

With respect to the effect of evidence, recall that receivers are more likely to accept claimed good hands in the SR11 and RV11 treatments compared to BASE11, but not in SR9 and RV9 compared to BASE9 (Result **??**). Figure OA.B.4 depicts the acceptance rates for claimed good hands across periods and treatments for each T value.

Figure OA.B.4: Effect of evidence on acceptance rates across periods (claimed good hands only)



Note: The lines represent predicted rates from probit regressions (standard errors clustered at the matching group level).

For T9, all treatments showcase a stable pattern across periods. For T11, while the acceptance rates in SR11 and RV11 are stable, there is a strong downward trend in BASE11, suggesting that, if anything, Result **??** is stronger over time. This is

Table OA.B.5: Probit analysis of acceptance rates across periods (claimed good hands only)

	Dependent variable:	
	Acceptance decision	
	(T11)	(T9)
(1) Treatment = SR	−0.042*	−0.001
	(0.024)	(0.006)
(2) Treatment = RV	−0.032	−0.065***
	(0.031)	(0.010)
(3) Period x (Treatment = SR)	−0.002***	−0.004***
	(0.001)	(0.001)
(4) Period x (Treatment = RV)	−0.001	0.001***
	(0.001)	(0.000)
(5) Period x (Treatment = BASE)	−0.013***	−0.002
	(0.001)	(0.002)
Observations	3,780	3,502
χ^2 for (3) = (4) = (5)	130.15*** (df=2)	40.297*** (df=2)

Note: The table presents marginal effects; data includes only bad hands; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

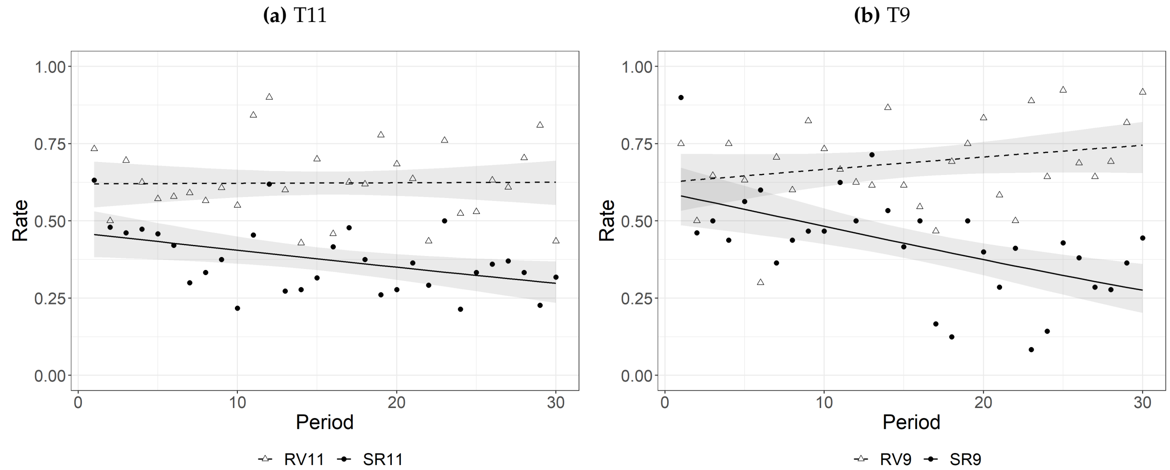
supported by the probit analysis presented in Table OA.B.5. This analysis also picks up significant trends in the SR9 and RV9 treatments. However, these coefficients are very small.

Turning to the effect of verification control recall that our main result regarding receiver's acceptance decision is that the acceptance rate conditional on the observed value is higher in RV than SR, significantly so for observed values 3-7 in T11 (Result 10) and 3-6 in T9. We now check the robustness of this result across periods.

Figure OA.B.5 shows the acceptance rates in each treatment across periods. We focus on cases where a good hand was reported and the observed value was between 3 and 7 for T11 and between 3 and 6 for T9. The acceptance rates in RV are consistently above those in SR. A decreasing trend in the acceptance rate in the SR treatments leads to an increase in the difference between treatments as subjects gain more experience.

Table OA.B.6 presents the marginal effects from a probit regression of the acceptance decision on the SR treatment dummy, interaction terms between period and each treatment, and the value of the observed card, for T11 and T9 separately. The results suggest that the treatment difference is large and highly significant even after controlling for period effects irrespective of the value of T.

Figure OA.B.5: Acceptance rates across periods (claimed good hands only, observed values 3-7 for T11 and 3-6 for T9)



Note: The lines represent predicted rates from probit regressions (standard errors clustered at the matching group level).

Table OA.B.6: Probit analysis of the acceptance decision (claimed good hands only, observed values 3-7)

	Dependent variable:	
	Acceptance decision	
	(T11)	(T9)
(1) Treatment = SR	−0.278***	−0.124**
	(0.060)	(0.061)
(2) Period x (Treatment = SR)	−0.006**	−0.012***
	(0.003)	(0.001)
(3) Period x (Treatment = RV)	−0.001*	0.005
	(0.000)	(0.004)
(4) Value of observed card	0.172***	0.240***
	(0.033)	(0.020)
Observations	1,304	826
χ^2 for (1) = 0 & (2) = (3)	305.82*** (df=2)	200.58*** (df=2)

Note: The table presents marginal effects; the data excludes cases where the reported values add up to less than 11 (9) and the observed value is less than 3 or greater than 7 (6); standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

OA.B.4 *Outcomes and payoffs*

Figure OA.B.6 shows the acceptance rate in each treatment across periods. This is also the sender's average payoff. The results of a probit analysis are reported in Table OA.B.7. For T11 we observe a strong negative trend in acceptance rates in BASE11, which is also the main driver of the effect of evidence on sender's payoff. Although the marginal effect of being in the SR11 or the RV11 is negative, together with a lack of significant trend in these treatments and a strong negative trend in BASE11, the positive effect of evidence on sender's payoff is confirmed. In T9, the main effect coefficient of SR9 is positive but insignificant but there is a small negative trend, which is not the case in BASE9. The main effect of RV9 is negative and significant but we also see a small positive trend. These factors cancel each other out, leading to a lack of overall effect of evidence on the sender's payoff in T9.

Figure OA.B.7 shows the receiver's average payoff across periods. The results of a probit analysis are reported in Table OA.B.8. First, we confirm a strong and significant positive effect of evidence on receiver's payoff after controlling for period trends for both T11 and T9. In terms of the effect of verification control, we find a significant difference in the coefficients of the main effects in of SR11 and RV11. However, we also find a slight increasing trend in SR11 and a slight decreasing trend in RV11 which makes the overall difference between payoffs go away after a few rounds. We find a similar difference in the coefficients for the main effect of SR9 and RV9, but this time no significant trend differences. Although the difference is small, this suggests that there is a potential for larger differences with more experience.

Table OA.B.7: Probit analysis of acceptance rate (sender average payoff)

	Dependent variable:	
	Acceptance decision (sender payoff)	
	(T11)	(T9)
(1) Treatment = SR	-0.069^{***}	0.012
	(0.0211)	(0.108)
(2) Treatment = RV	-0.070^{**}	-0.047^{***}
	(0.035)	(0.108)
(3) Period x (Treatment = SR)	-0.001	-0.004^{***}
	(0.001)	(0.004)
(4) Period x (Treatment = RV)	0.000	0.002^{**}
	(0.002)	(0.004)
(5) Period x (Treatment = BASE)	-0.011^{***}	-0.000
	(0.001)	(0.004)
Observations	4,320	3,780
χ^2 for (1) = (2)	0.003 (df=1)	37.193^{***} (df=1)
χ^2 for (3) = (4)	0.339 (df=1)	24.299^{***} (df=1)
χ^2 for (3) = (5) & (3) = (4)	69.099^{***} (df=2)	24.335^{***} (df=2)

Note: The table presents marginal effects; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

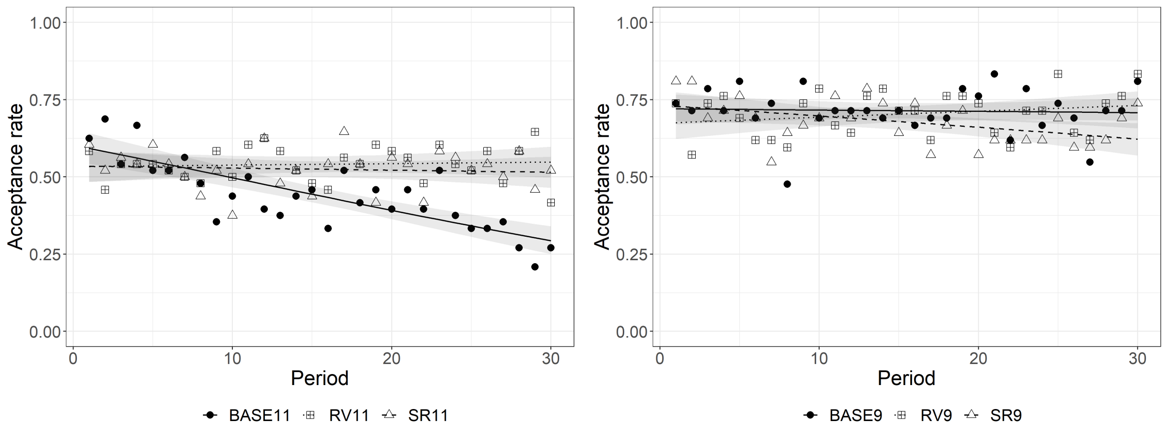
Table OA.B.8: Probit analysis of receiver average payoff

	Dependent variable:	
	Probit analysis of receiver average payoff	
	(T11)	(T9)
(1) Treatment = SR	0.185^{***}	0.105^{***}
	(0.038)	(0.115)
(2) Treatment = RV	0.249^{***}	0.138^{***}
	(0.036)	(0.119)
(3) Period x (Treatment = SR)	0.002^{*}	-0.001
	(0.001)	(0.005)
(4) Period x (Treatment = RV)	-0.002^{***}	0.000^{**}
	(0.001)	(0.005)
(5) Period x (Treatment = BASE)	-0.001	-0.004^{***}
	(0.003)	(0.004)
Observations	4,320	3,780
χ^2 for (1) = (2)	153.79^{***} (df=1)	5.628^{**} (df=1)
χ^2 for (3) = (4)	12.327^{***} (df=1)	1.932 (df=1)
χ^2 for (3) = (5) & (3) = (4)	12.330^{***} (df=2)	$> 4000^{***}$ (df=2)

Note: The table presents marginal effects; standard errors in parentheses are clustered at the matching group level; *p<0.1; **p<0.05; ***p<0.01.

Figure OA.B.6: Acceptance rate (sender's average payoff) across periods

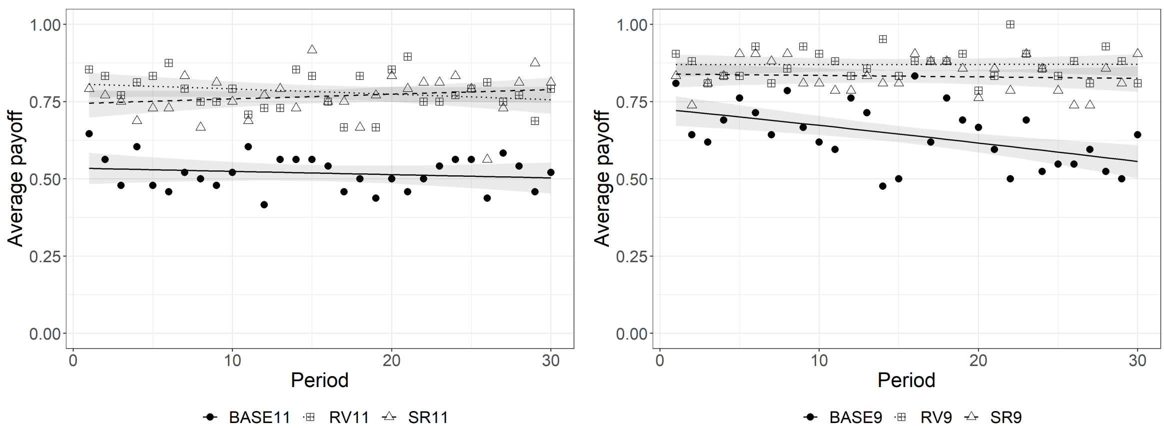
(a) T11 **(b)** T9



Note: The lines represent predicted averages from probit regressions with standard errors clustered at the matching group level.

Figure OA.B.7: Receiver's average payoff across periods

(a) T11 **(b)** T9



Note: The lines represent predicted averages from probit regressions with standard errors clustered at the matching group level.