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The ego is no fool: Absence of motivated belief formation in strategic interactions

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ABSTRACT

We investigate whether individuals are more easily fooled by others when they enhance their personal characteristics and abilities. We use an experiment in which participants complete an IQ test and then play a sender–receiver game. The experiment has a 2x2 factorial design. First, we determine the state either by the receiver's relative performance or by a randomly drawn number. Second, monetary incentives, which are common knowledge, are such that the sender is better off (worse off) when the receiver's action is about him being of high (low) rank, while the receiver benefits from selecting the action that matches his true rank. We find that receivers are not more likely to believe senders or to move their action further from their prior beliefs when they provide news that carries ego-relevant information about themselves, compared to the cases in which the news carries no ego-relevant information.

1. Introduction

There is mounting evidence that belief formation is subject to motivated biases: individuals process information in ways that serve their ego. What is less known is whether the desire to hold positive views about oneself shapes interactions with economic and financial consequences. In particular, individuals might be more easily fooled if others flatter their personal characteristics to get an economic advantage. Take the case of a car dealer (or even a private citizen) trying to sell a sports car. The dealer might be interested in making the customers believe that they have good driving skills, which will enable them to enjoy the vehicle entirely. The customers, on the other hand, might be more than happy to believe they are future Formula One champions. Think about a sales agent in a fashion store. The agent will have an incentive to make the customers believe they look shining in the suit they are thinking of buying. The customers might be very happy to hold the conviction of being able to appear on the Vogue cover.

Understanding whether motivated beliefs shape social and economically relevant interactions is crucial. Indeed, while previous literature has shown that individuals process self-servingly ego-relevant information that comes from objective and impartial sources, little is known about how individuals process such information when it comes from people they are transacting with. Specifically, we do not know how they process information when their counterpart profits if the former engages in motivated belief formation. If the individuals fail to account for potential bias in the information received, because they want to believe well of themselves, there could be many economically relevant implications. For instance, motivated biases may lead to sub-optimal market equilibria in which individuals are constantly fooled about their personal qualities and skills. This may also help explain why individuals are generally overconfident about their personal characteristics (Bolger et al., 2019; Moore & Healy, 2008). If, on the other hand, individuals acknowledge that information may be biased because of others' incentives and are skeptical about, we might be able to conclude that motivated information processing has bounds that limit its impact on economic interactions.

In this paper, we provide first evidence that motivated belief formation does not affect economically relevant interactions. We specifically investigate whether individuals are more easily fooled when others positively and strategically praise the personal characteristics that they care about in an exaggerated way. While this dynamic may be prominent in many economic interactions, it is difficult to identify it cleanly. An experiment in a controlled environment is useful for assessing motivated belief formation and its economic implications.

We conduct a simple experiment with an economic interaction in which: (1) there is social transmission of ego-relevant information; (2)

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incentives are misaligned between who sends and who receives the information; and, (3) the outcome variables make it possible to study the influence of the information transmitted on actions and beliefs. In the experiment subjects play a sender–receiver game. The sender sends a message about the state of the world to the receiver, who then takes an action. While the sender profits most when the receiver takes a specific action, the receiver's optimal action is to guess and match the actual state of the world. The experiment has a 2×2 factorial design. We vary whether the state of the world is determined by the receivers' performance in an IQ test (ego-relevant condition), or by a random number (non-ego-relevant condition). We then vary whether the sender's incentive is for the receiver to take an action that corresponds to him being of a high rank (positive condition) or of a low rank (negative condition). For receivers, instead, across all conditions their incentive is correctly guessing the true state, with the payoff decreasing as the guess diverges in either direction from the truth. Hence, an action of the receiver corresponds to the receiver putting forward a guess of his relative ranking. Before and after the game we elicit beliefs about the receiver's relative ranking.

The experimental results show that receivers are not more likely to follow and believe the messages from senders when they carry good news (or bad news) about their relative ability. In particular, while news has a strong impact on actions played, this does not have any differential impact by the ego-relevance of the news. Additional analyses further confirm that there are no systematic differences across experimental conditions. The same pattern holds for the beliefs of the receivers on their own ranking. They incorporate news in their beliefs, but not in a differential way depending on the ego relevance of the treatment. Overall, the experimental results strongly suggest that motivated belief formation is bounded, and while individuals desire to hold positive views about themselves, this does not make them oblivious to the economic context of the information exchange. Individuals in the experiment account for the strategic incentives of who is sending the information irrespective of whether the information is ego-relevant or not.

2. Relation to the literature

This paper contributes to: the literature on motivated cognition in psychology, specifically, the experimental evidence on how information is processed in light of self-enhancement motives; the literature in economics on motivated beliefs about ego-relevant personal characteristics; and the literature on communication games in economics.

An extensive literature in psychology (Alicke & Sedikides, 2009) shows that individuals have a basic desire to believe good things about themselves (self-enhancement motive), while protecting themselves against having negative self-views (self-protection motive). There are many possible mechanisms through which individuals can engage in motivated reasoning, one of which is information processing. There is experimental evidence that information that is consistent with a preferred conclusion is examined less critically than information that is not (Ditto & Lopez, 1992; Kunda, 1990; Pyszczynski & Greenberg, 1987). Similarly, experimental evidence shows that individuals tend to accept positive statements about the self without giving much thought to the motives of the person making such statement (Vonk, 2002). These studies strongly suggest that individuals may be misled by others about their personal characteristics in economic interactions. We contribute to this literature by analyzing the effects of motivated reasoning where there is flattery and ingratiation in a game that captures important features of many economically relevant interactions.

A relatively recent literature in economics has drawn interest and inspiration from the psychological evidence on motivated cognition and has studied closely how individuals process ego-relevant information. Theoretical work has emphasized how ego motives may affect the way people process information (Bénabou & Tirole, 2016). Moreover, experimentally many of these advanced mechanisms have been shown to fuel overconfidence about individuals' personal characteristics. These include: selective recall (Chew et al., 2020; Zimmermann, 2020),[1] motivated errors (Exley & Kessler, 2019), and asymmetric updating (Eil & Rao, 2011). Usually these papers look at how individuals process ego-relevant information that is provided by an objective and precise mechanism. The main finding is that they process ego-relevant information self-servingly. That is, subjects are more likely to remember positive than negative performance feedback, they are more likely to commit (motivated) mistakes to reach more flattering beliefs about themselves, and they tend to update more strongly to positive than negative signals about their ability. This paper is closest in spirit to the asymmetric updating literature since we study individuals' reaction to ego-relevant news. The evidence on asymmetric updating is somehow inconclusive. While initially (Eil & Rao, 2011; Möbius et al., 2022) found evidence of asymmetric updating, other papers failed to find it (Buser et al., 2018; Coutts, 2019; Ertac, 2011; Schwardmann & Van der Weele, 2019). More recent papers identified conditions under which asymmetric updating is more likely to arise (Castagnetti & Schmacker, 2022; Coutts et al., 2019). In non-strategic settings, Oprea and Yuksel (2021) studied how individuals jointly update beliefs about their IQ performance, while Gneezy et al. (2017) examined the conditions under which people provide accurate feedback to others about their physical appearance. In this setting, there is suggestive evidence that individuals update their beliefs in a self-serving fashion. To this literature, we crucially add the social exchange of ego-relevant information in a strategic environment. Finally, Schwardmann and Van der Weele (2019) and Soldà et al. (2019) showed experimentally that individuals' level of (over)confidence is shaped by whether it helps in social interactions. Using a different approach, we look at whether one is deceived by others because of the ego-relevance of the messages.

We also contribute to the experimental literature on communication experiments. In particular, to the literature on cheap talk (sender–receiver) games, where the sender is informed about the state of the world and there is a misalignment of interests between senders and receivers (Blume et al., 2020, offer a review of the topic). Indeed, the experimental design that we implement here is based on a cheap talk game that borrows features from Cai and Wang (2006) and Wang et al. (2010). In brief, the experimental findings are that senders reveal more information and receivers react more to the messages than predicted by the theory (Crawford & Sobel, 1982). Relatedly, in similar experimental settings (e.g. Sánchez-Pagés & Vorsatz, 2009; Serra-Garcia et al., 2011) and in settings in which lying is not permitted but subjects can withhold or make the information transmitted more complex to interpret (e.g. Jin et al., 2021, 2022), there is ample evidence that receivers make inferential mistakes when assessing the senders' messages. That is, they are insufficiently skeptical to false, empty, vague, or complex messages. Moreover, Soraperra et al. (2023) study the transmission of inconvenient information in social interactions regarding altruistic motives and find that this setting increases selfish decisions. We add to this literature the study of receivers' behavior in communication games where the state is ego-relevant, and study how it affects behavior compared to the standard case where the state is not ego-relevant. The study of senders' behavior started a literature on deception and lying aversion (Erat & Gneezy, 2012; Gneezy, 2005). In this paper, we focus on receivers' actions and, therefore,we do not analyze senders' behavior. However in a companion paper (Burro & Castagnetti, 2022) we look at deception rates by ego-relevance of the state. In short, we do not find any evidence that lying depends on the ego-relevance of the state.[2] Another closely related paper is that of Ho and Yeung

[1] Also Caballero and López-Pérez (2020) find evidence of self-serving recall in a payoff-relevant setting, which is, however, not about personal characteristics.

[2] Thaler (2023) studies how motivated reasoning affects information transmission in a different domain, that of political preferences. He finds that senders are less likely to transmit truthful information when incentivized to do so, to please the receivers' beliefs. Receivers do not anticipate this behavior and respond equally across treatments.

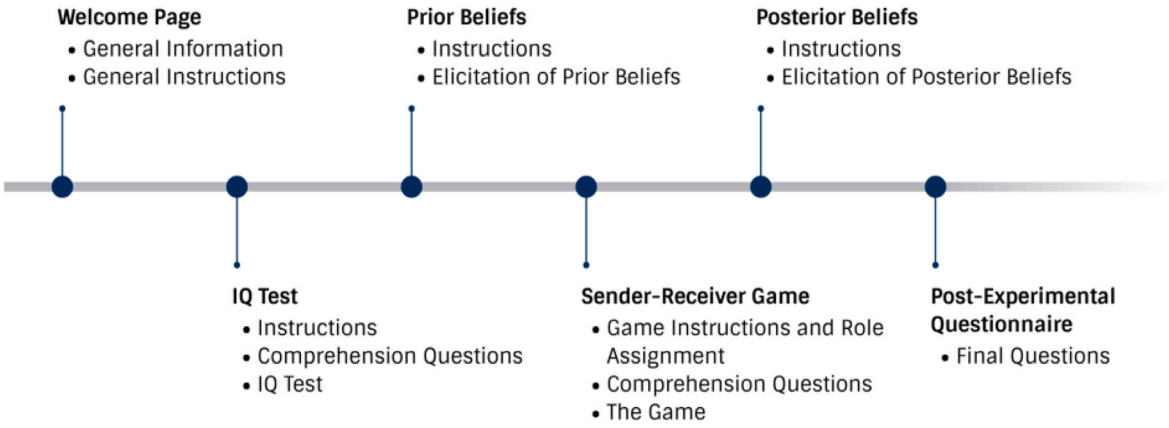

Fig. 1. Timeline of the experiment.

(2014) who study performance feedback in an agent–client setting. They find that agents inflate the feedback and clients report higher levels of happiness. Differently from us, they do not have a setting with misalignment of incentives and they do not control for prior beliefs.[3]

Most importantly, the closest work to ours is that of Hagenbach and Saucet (2023), who also implement a sender–receiver game to study how receivers interpret ego-relevant messages. On top of this, the experiment features similar treatment variations to ours which include the ego-relevant and payoff variations. Interestingly, this paper does not find motivated belief formation in the positive condition, as in our study. However, it does find that, in the negative conditions, receivers are less skeptical when the messages relate to their IQ rank. These different results may be explained by differences in both experiments: (i) the message, which as opposed to us, had to contain the true state; (ii) in Hagenbach and Saucet (2023) the message need not be a singleton (e.g., a message might contain a set of ranks); (iii) their experimental subjects play repeatedly the one-shot game whereas in our case they play once. The two papers complement each other and show that the results may depend on specific features of the game. Moreover, we further contribute to this literature by studying the effect of the messages, not only on actions but also on receivers' (posterior) beliefs.

Overall, we contribute a single, important finding to the literature. Despite extensive literature in both economics and psychology that shows that individuals engage in motivated reasoning, our results show that this effect is constrained by the environment. There are limits to motivated reasoning that prevent people from forming biased beliefs about themselves. In particular, in the case of this experiment, receivers react to their environment by realizing others' stakes in the game and not internalizing the positive messages senders send. These boundary conditions of motivated reasoning are explained by Bénabou and Tirole (2016) framework and what they refer to as the constraints of reality. By this they mean that while individuals are willing to engage (consciously or not) in motivated reasoning (the demand of motivated beliefs), their ability to do so is not infinite. They are constrained by the environmental cues (e.g. the supply side) limiting their ability to form high beliefs of themselves.

[3] Examples of other important differences are the following. We look at relative performance (i.e., receivers' IQ performance relative to the performance of other individuals) instead of absolute performance (i.e., the number of questions solved correctly by the receiver). Arguably, the former is more ego-relevant than the latter. We also study the effect of messages on beliefs. We are able to do this since we elicit posterior beliefs.

3. Experimental design

To causally investigate whether subjects are more easily deceived when others inflate their personal characteristics, an experiment with the following features is required. First, a game with at least two players and the ability to transmit messages. Second, an action that measures ones' propensity to follow the messages and an incentive compatible mechanism to study the impact of the messages on beliefs. Third, exogenous variation in the ego relevance of the task (i.e., whether messages are about one's personal characteristics or not). This environment can be created in a laboratory. There are two parts to the experiment. Subjects are asked to complete an IQ test and then play a sender–receiver game. Senders are informed about the state of the world and send a message about the state to receivers, who then have to guess the state. The incentives in the game are such that the receivers' best interest is that their actions match the state, while senders profit the most from receivers taking a specific action.

The experiment features a 2×2 between-subject design. First, we vary the ego-relevance of the state. In the ego-relevant (non-ego-relevant) condition the state is determined by the receiver's performance in the IQ test (by a random draw). Second, we vary the payoffs in the game. In the positive (negative) condition, senders profit the most when the receivers take a high (low) ranked action in the game, corresponding to them being in the top (bottom) of the rank.[4] Senders' incentives are such that they profit the most when playing an action that matches the true stat of the world. Before and after the game, we elicit receivers' beliefs about their ranking, and senders' beliefs about the receivers' beliefs. Fig. 1 shows the timeline of the experiment.

3.1. The IQ test

The experiment started with an IQ test, the Raven Advanced Progressive Matrices (APM) test. We administered 20 matrices from Set II of the APM. This set is appropriate for adolescents and adults of average intelligence because it differentiates across the entire range of adult ability.[5] In each question, subjects were shown a 3×3 matrix of pictures with the one in the bottom right corner missing and asked to find the image (out of 8 possible choices presented below the matrix) that completes the pattern. Fig. 2 shows one example. In the Appendix we report all the matrices we used in the experiment.

[4] We will call a "high ranked action" (or "high ranked message") an action (message) that corresponds to rankings closer to the top. Conversely, for "low ranked action" (or "low ranked message").

[5] This is particularly suitable for university students, who are on average of high IQ ability.

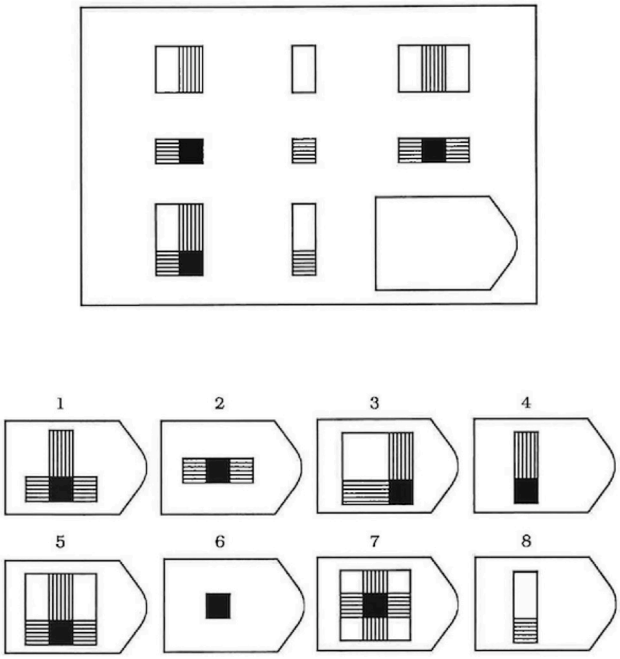

Fig. 2. Raven Matrix Example. The figure displays matrix 11 from Set II of the APM test. Image number 5 completes the pattern.

Subjects were given detailed instructions. They had 10 min to answer the 20 questions. They could be answered in any order and answers could be changed, within the time limit. Financial rewards are not usually given with this test, but we decided to pay subjects 5.00 Peruvian Soles per correct answer out of three randomly chosen questions.[6] We did this to increase subjects' motivation to perform well. This meant that poor performance in the test could not be ex-post rationalized by lack of attention, effort, or willingness to perform well.

Importantly, we also truthfully informed subjects that this test is often used to measure fluid intelligence (i.e., reasoning ability) and general intelligence; and that high scores in this test highly correlate with economic variables like income and occupation and health variables like health quality and longevity (Sternberg et al., 2001). This was accomplished to increase the ego-relevance of the task.

3.2. The sender–receiver game

After the test, subjects were randomly and evenly sorted into: senders and receivers. The software randomly created sender–receiver pairs that played the sender–receiver game. To prevent framing effects, in the experiment senders (receivers) were called Player 1 (Player 2). In the game, the sender is informed about the state of the world (the "realized state"), which can take any value in the state space, $S_s = \{1, 2, 3, \dots, 10\}$, and that depends on the receiver's rank. Both players are aware of how the state of the world is determined. The sender then decides which message, m_s, to send to the receiver. The message space corresponds to the state space: $M_s = S_s = \{1, 2, 3, \dots, 10\}$. The receiver chooses an action, $a_r \in A_c = \{1, 2, 3, \dots, 10\}$, after receiving the message. Payoffs are determined by both the receiver's action in the game and the state of the world. Fig. 3 gives a visual representation of the game. To make sure that subjects understood the main features of the game, they were asked to complete a comprehension questionnaire. They could not play the game until they answered these questions correctly.

[6] At the time of the experiment (June, 2020), the exchange rate was: $ 1.00 = Peruvian Soles 3.54).

3.2.1. Treatment variations

To study causally whether individuals are more likely to be fooled when the news they hear positively enhances their ego, the experiment features a 2 × 2 factorial design. The factors correspond to variations in the ego-relevance of the state and how payoffs are determined in the game. We explain them in detail below.

Ego relevance variation In the ego-relevant condition, receivers were ranked according to their IQ scores. In particular, their scores were compared to 9 other subjects who took part in a pilot session. They were informed of this ranking procedure and that the scores elicited a strict ordering. If two or more subjects had the same score, then it was randomly determined whose rank was higher.[7] In the non-ego-relevant condition, participants were assigned a random rank position, which was determined following a random draw from a specific distribution.[8] In a between-subject design, these distributions could take one of the following forms: (1) uniform distribution where each rank was drawn with equal probability; (2) a positively skewed distribution where higher rankings were drawn with higher probability; and, (3) a negatively skewed distribution where lower rankings were drawn with higher probability. We varied the distributions to have exogenous variation in prior beliefs in the non-ego-relevant condition. In particular, we informed players how the rank was determined and the specific distribution from which the rank would be randomly assigned. In the Appendix, we provide a detailed description of the distributions.

With this experimental variation we could study whether receivers are more likely to follow high ranked messages (and "good" news) when the state is about their relative performance in the IQ test, compared to the case in which the state has been randomly determined via the assignment of a random rank position.

Payoff variation The sender's payoff was determined by the receiver's action in the game. In the positive condition, her payoffs increased monotonically as the receiver played higher ranked actions in the game. In the negative condition, payoffs were reversed: the sender's payoff monotonically increased as the receiver played lower ranked actions. In both conditions, therefore, the sender's payoff was not dependent on the receiver's rank. The receiver's payoff in the game (and irrespective of the condition) was determined by both his action and the realized state. In particular, the receiver's payoff was maximum when his action matched the state and monotonically decreased as his action deviated (in absolute terms) from the realized state. Fig. 4 shows the payoff structure for both players and by condition. The payoffs for both senders and receivers are similar to the ones in Jin et al. (2021) and Wang et al. (2010). Both players knew the payoff structure in the game and they were explicitly made aware of the misalignment of interests in game incentives across roles.

With this variation we can investigate the link between the ego-relevance of the state and being fooled. In particular, we can study

[7] We opted for relative performance rather than absolute performance as the former arguably holds greater ego-relevance than absolute performance for the following reasons. First, absolute performance feedback is subject to external factors such as test difficulty, lenience of the marker, among others. These variables may limit the amount of information disclosed to the subject, and therefore reduce the ego-relevance of the task. In the case of relative performance feedback, these factors are limited and, specifically in the case of the experiment at hand, are fully absent. Second, while in the literature there is evidence of motivated belief formation relative to ego-relevant tasks where performance is assessed in relative terms (e.g., Castagnetti & Schmacker, 2022; Hagenbach & Saucet, 2023; Zimmermann, 2020), the evidence is much weaker when the assessment is conducted in absolute terms (e.g., Cavalan et al., 2023; Grossman & Owens, 2012). Finally, theories in psychology argue that people evaluate their abilities by comparison with the abilities of others, implying that people specifically care about relative performance rather than absolute performance (Festinger, 1954; Garcia & Tor, 2007).

[8] Thus, it is important to note that in the non-ego relevant condition the ranking was not determined relative to other participants in the experiment.

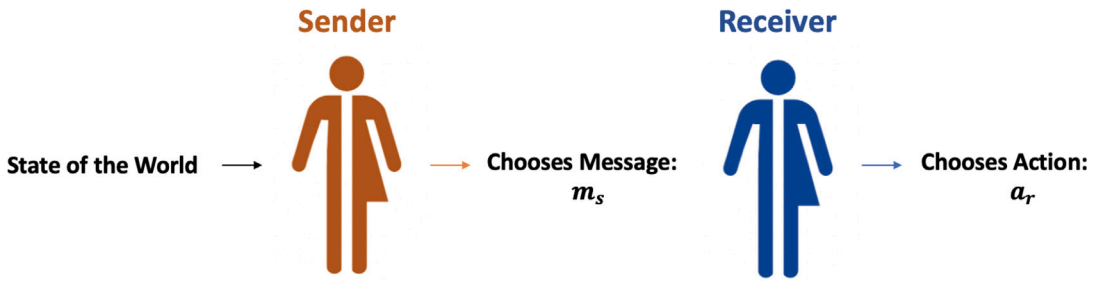

Fig. 3. The sender–receiver game.

	Receiver's Action in the Game									
	1	2	3	4	5	6	7	8	9	10
Receiver's Ranking = 1	15,15	14,14	13,13	12,12	11,11	8,8	7,7	5,5	3,3	1,1
Receiver's Ranking = 2	15,14	14,15	13,14	12,13	11,12	8,11	7,8	5,7	3,5	1,3
Receiver's Ranking = 3	15,13	14,14	13,15	12,14	11,13	8,12	7,11	5,8	3,7	1,5
Receiver's Ranking = 4	15,12	14,13	13,14	12,15	11,14	8,13	7,12	5,11	3,8	1,7
Receiver's Ranking = 5	15,11	14,12	13,13	12,14	11,15	8,14	7,13	5,12	3,11	1,8
Receiver's Ranking = 6	15,8	14,11	13,12	12,13	11,14	8,15	7,14	5,13	3,12	1,11
Receiver's Ranking = 7	15,7	14,8	13,11	12,12	11,13	8,14	7,15	5,14	3,13	1,12
Receiver's Ranking = 8	15,5	14,7	13,8	12,11	11,12	8,13	7,14	5,15	3,14	1,13
Receiver's Ranking = 9	15,3	14,5	13,7	12,8	11,11	8,12	7,13	5,14	3,15	1,14
Receiver's Ranking = 10	15,1	14,3	13,5	12,7	11,8	8,11	7,12	5,13	3,14	1,15

(a) Payoff Table in the Positive Condition

	Receiver's Action in the Game									
	1	2	3	4	5	6	7	8	9	10
Receiver's Ranking = 1	1,15	3,14	5,13	7,12	8,11	11,8	12,7	13,5	14,3	15,1
Receiver's Ranking = 2	1,14	3,15	5,14	7,13	8,12	11,11	12,8	13,7	14,5	15,3
Receiver's Ranking = 3	1,13	3,14	5,15	7,14	8,13	11,12	12,11	13,8	14,7	15,5
Receiver's Ranking = 4	1,12	3,13	5,14	7,15	8,14	11,13	12,12	13,11	14,8	15,7
Receiver's Ranking = 5	1,11	3,12	5,13	7,14	8,15	11,14	12,13	13,12	14,11	15,8
Receiver's Ranking = 6	1,8	3,11	5,12	7,13	8,14	11,15	12,14	13,13	14,12	15,11
Receiver's Ranking = 7	1,7	3,8	5,11	7,12	8,13	11,14	12,15	13,14	14,13	15,12
Receiver's Ranking = 8	1,5	3,7	5,8	7,11	8,12	11,13	12,14	13,15	14,14	15,13
Receiver's Ranking = 9	1,3	3,5	5,7	7,8	8,11	11,12	12,13	13,14	14,15	15,14
Receiver's Ranking = 10	1,1	3,3	5,5	7,7	8,8	11,11	12,12	13,13	14,14	15,15

(b) Payoff Table in the Negative Condition

Fig. 4. Payoff Table by Condition. The tables show the payoff structure by payoff condition. In the top panel (a) the table displays the payoff matrix for the positive payoff condition, while in the bottom panel (b) the table displays the payoff matrix for the negative payoff condition. The columns indicate the receiver's action in the sender–receiver game, while the rows indicate the realized state of the world, which corresponds to the receiver's actual ranking. In each cell, the left entry (in red) shows the sender's payoff, while the right entry (in blue) shows the receiver's payoff. Payoffs are in Peruvian Soles.

whether there are asymmetric responses to negative news by ego-relevance of the state. These analyses are crucial as they will allow us to exclude other confounding effects that may be affecting differences in actions by the ego-relevance of the state. For instance, receivers might believe that senders are more trustworthy when the messages they send are about their personal characteristics. If, instead, receivers'

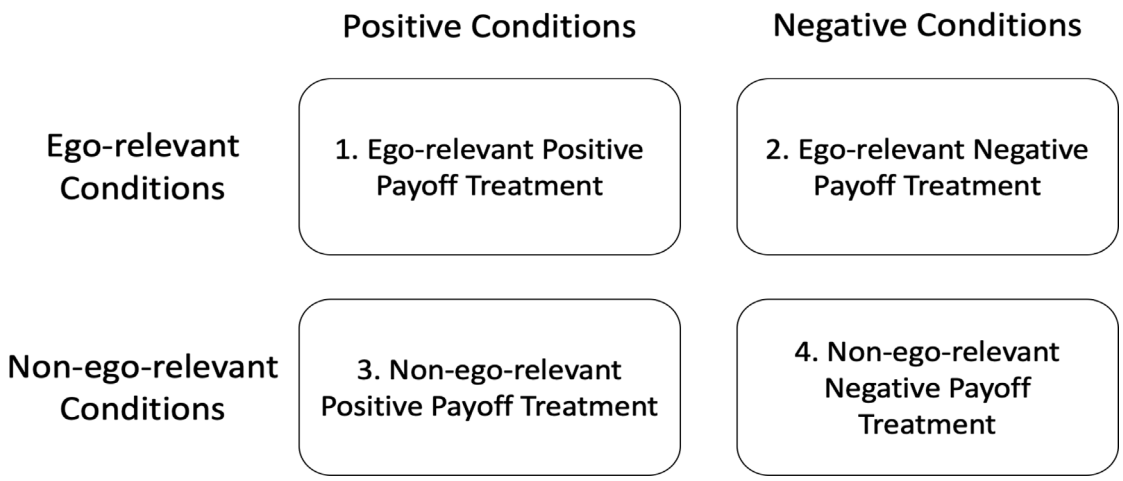

Fig. 5. Summary of experimental conditions and corresponding treatments.

actions are driven by ego-relevant motives, then we should expect the opposite predictions in the negative conditions: receivers in the ego-relevant treatment will be less likely to follow "bad" news, relative to the non-ego-relevant condition. Fig. 5 provides a summary of the resulting experimental treatments.

3.3 Prior and posterior beliefs

Before and after the sender–receiver game, we asked participants about the following set of beliefs.

Receivers' beliefs We asked receivers their prior (posterior) beliefs about their ranking before (after) the sender–receiver game. At the time we asked participants their prior beliefs, they did not know what they would be doing in the next step of the experiment. In the ego-relevant condition this corresponded to their relative ranking in the IQ test. In the non-ego-relevant condition, it corresponded to the random draw. We elicited the full distribution of these prior beliefs. That is, receivers had to write down their estimated probability of being in each of the 10 ranks.

Senders' beliefs We asked senders to report their beliefs about what their matched receivers thought their mean rank was before and after the game. Again, we elicited the entire distribution of the prior (posterior) beliefs.[9] Importantly, before the belief elicitation stage, senders were informed about their matched receiver's rank, how the rank was determined, and that the receivers did not know their true rank.

The elicitation of prior and posterior beliefs is crucial to the experiment. First, when analyzing game play, prior beliefs makes it possible to define messages as carrying "good" or "bad" news. It will be also crucial to study receivers' actions in the game controlling for prior beliefs. Conversely, one could acknowledge differences in game play that ultimately are not driven by ego motives, but, instead, by differences in prior beliefs. Second, posterior beliefs allow us to analyze whether messages in the game influence not only actions but also beliefs about the receivers' rankings.

We used a financial incentive for the elicitation procedure. It consisted in the Binarized Scoring Rule proposed by Hossain and Okui (2013), and a fixed price of 20.00 Peruvian Soles. Under this method, truthful reporting is orthogonal to subjects' risk preferences and it does not rely on Expected Utility Theory (Schotter & Trevino, 2014). We explicitly and truthfully told participants that the elicitation mechanism guaranteed that it was in their best interests to report their true beliefs. We did not explain to subjects how the procedure worked, as withholding the description of the mechanism increases truthful reporting (Danz et al., 2022). The interested participants, however, could click on a button to read a detailed description of the elicitation method.

[9] For both belief questions and roles, we imposed the natural constraint that these probabilities needed to sum up to 100%.

3.4 Post-experimental questionnaire

At the end of the experiment, subjects were asked a set of unincentivized questions. First, senders were asked to report the probability with which they thought that their matched receivers followed the message they sent. Similarly, receivers were asked to report the probability with which they believed that their matched senders sent a truthful message. We then asked them a general willingness to take risks question (Dohmen et al., 2011). Finally, participants completed a demographic questionnaire that included questions about their age, gender, and student status.

3.5 Implementation

The experiment took place in June 2020. We recruited subjects through the Orsee recruitment system and we used the pool of participants registered at the economics laboratory of Universidad Catolica del Perú in Lima, Perú. We recruited 317 participants, for the receiver role: 53 for the non-ego-relevant and positive treatment; 143 for the ego-relevant positive treatment; 52 for the non-ego-relevant and negative treatment; 69 for the ego-relevant and negative treatment. On average, sessions lasted 45 min. Participants earned an average of 12.00 Peruvian Soles, including the show-up fee of 5.00 Peruvian Soles. We programmed and conducted the experiment in oTree (Chen et al., 2016). The Appendix shows the experimental instructions (translated from Spanish). Descriptive statistics of the sample of receivers are provided in Appendix.

The sessions were conducted online. Each participant registered in advance (and only once) for an online session that took place at a particular day and time. Registered participants received a reminder the day of the session. Two research assistants supervised the sessions and participants could contact them (via email or text message) in real time if needed.

4 Research hypotheses

The experiment is designed to test whether individuals are more likely to follow "good" news that is ego-relevant, compared to the case in which the same news is not. In other words, the experimental conjecture is that individuals will be more easily fooled when they hear positive news about their personal characteristics, relative to the case

in which the messages do not carry any ego-relevant content. Similarly, if ego-relevance drives behavior in the positive conditions, an opposite effect should emerge in the negative conditions. That is, "bad" news will not be followed as much in the ego-relevant treatment compared to the non-ego-relevant negative treatment. The first hypothesis is therefore:

Hypothesis 1. Individuals in the positive ego-relevant treatment will be more likely to follow messages that carry "good" news, relative to those in the positive non-ego-relevant one. Conversely, individuals in the negative ego-relevant treatment will be less likely to follow messages that carry "negative" news, relative to those in the negative non-ego-relevant one.

Moreover, if individuals desire to interpret information in a self-serving way, the effects of messages might not be circumscribed to actions in the game, but they may affect (posterior) beliefs as well. In particular, individuals will interpret information in the ego-relevant treatments self-servingly (i.e., they will be more likely to update their beliefs following "good" news, while they will stick to their priors following "bad" news), while this effect will not hold in the non-ego-relevant conditions. Thus, the second experimental hypothesis is:

Hypothesis 2. Individuals in the positive ego-relevant treatment will be more likely to update their beliefs downwards (of being in a higher rank) following "good" news, relative to those in the positive non-ego-relevant one. Conversely, individuals in the negative ego-relevant treatment will be less likely to update their beliefs upwards (of being in a lower rank) following "bad" news, relative to those in the negative non-ego-relevant one.

5 Results

Before delving into statistical tests and regression analysis of our results, we present some descriptive statistics. Fig. 6 shows, in a parsimonious fashion, the main pieces of information of our results. The figure reports averages of the four metrics of analysis of our experiment. Namely, we report averages of the actions played, the prior and posterior beliefs of the receivers, and the messages sent by the senders. Fig. 6 already shows some interesting patterns in our results. First of all, prior beliefs are aligned between ego and non ego-relevant conditions. This reassures us that the exogenous variation in prior beliefs that we created in the non ego-relevant conditions led to a distribution of beliefs that closely mimics the one in the ego-relevant conditions. Second, senders communicate messages aligned with their incentives in the game, which on average are distant from receivers' prior beliefs. However, we do not see any clear patterns which differentiate the ego and the non ego-relevant conditions. This complements our finding from Burro and Castagnetti (2022), where we found no systematic differences in the deception rates due to the ego-relevance of the condition. More precisely, in Burro and Castagnetti (2022) we found that the ego-relevance of the condition does not lead the sender to send messages that are less aligned with the true rankings of the receivers. Here, we observe that the ego-relevance of the condition does not lead the sender to send messages that are less aligned with the prior beliefs of the receivers. In principle, receivers could still be more likely to follow the message of the senders in the ego-relevant condition, and this is the main focus of this work. Again, Fig. 6 gives us a first insight into this hypothesis. Actions are on average less aligned with prior beliefs and go in the direction that favors the senders, in all conditions. However, it does not seem to be the case that receivers more readily incorporate the message of the senders in the ego-relevant conditions with respect to the non ego-relevant ones. Posterior beliefs are less aligned with prior beliefs in the two negative conditions, while they are pretty close to prior beliefs in the two positive conditions. However, what matters is that posterior do not deviate more from prior beliefs in the ego with respect to the corresponding non ego-relevant condition.

In the Appendix, Figures A.1 to A.5 report the full distribution of these metrics in the whole sample and in the four conditions of the experiment. They show that patterns correspond to what we observed in Fig. 6. The Appendix reports also several sanity checks that: (i) show that actions respond to messages, with higher messages leading to higher actions (Figures A.6 and A.7); (ii) actions do not correspond 1-to-1 to messages since the slope of the relationship between actions and messages is lower than 1 (Figure A.6 and A.7); (iii) actions of the receivers are closely aligned to their posterior beliefs while they are not closely aligned with their prior beliefs (Figure A.8).

To address our first hypothesis more precisely, we focus on the value of the action chosen by the receivers. We see that this takes value of 4.64 (5.52) in the positive (negative) ego-relevant condition, and it takes value 4.30 (5.69) in the positive (negative) non-ego-relevant condition.[10] From these figures we can already see that, while the difference between the negative ego and non-ego-relevant conditions is small but it goes in the expected direction, the difference between the positive ego and non-ego-relevant conditions goes in the opposite direction with respect to what we had hypothesized. More specifically, the average action taken by the receiver is actually higher in the positive ego-relevant condition than in the non-ego-relevant one. We performed a one-sided t-test, with the following hypothesis:

$$H_0 : a_e \geq a_{ne} \quad H_1 : a_e < a_{ne}$$

where a_e is the action in the ego-relevant condition, and a_{ne} is the action in the non-ego-relevant one. In both the positive and the negative conditions, we could not reject the null hypothesis, with $p = 0.86$ and $p = 0.33$, respectively. We also performed the same test, by joining the negative and positive conditions. To be more precise, we tested if the average action taken in the two ego-relevant conditions is lower than the one taken in the two non-ego-relevant conditions. This test can be performed given that the hypothesized ego effects would work in the same direction in the positive and the negative conditions. This means that motivated beliefs would make individuals play lower actions. In the positive (negative) ego-relevant condition this implies that receivers will be more (less) likely to follow low (high) messages compared to the non ego-relevant ones. The average action taken in the two ego-relevant conditions is 4.93 and the one taken in the two non-ego-relevant conditions is 4.99. We could not reject the null hypothesis, with $p = 0.40$. To mitigate power concerns, we conducted an ex-post power analysis. We fixed the probability of false positive to the standard threshold, $\alpha = 0.05$. We reach the standard threshold of 80% power to detect a 0.71 difference between the ego and the non-ego-relevant conditions.[11] We will later argue that this is an effect of relevant magnitude.

To investigate this research question in greater detail, we now conduct econometric OLS regressions. They allow us to estimate the causal impact of the type of information by ego-relevance of the state while controlling for relevant regressors. In particular, we perform the following estimations:

$$Action_i = \alpha + \beta_1 Ego_i + \beta_2 Good/Bad\ News_i + \beta_3 Prior_i + \beta_4 Sdprior_i + \epsilon_i \tag{1}$$

$$Action_i = \alpha + \beta_1 Ego_i + \beta_2 Good/Bad\ News_i + \beta_3 Prior_i + \beta_4 Sdprior_i + \beta_5 Ego_i \times Good/Bad\ News_i + \boldsymbol{\delta}\mathbf{x_i} + \epsilon_i \tag{2}$$

We perform the analysis separately for the positive and the negative conditions. $Action_i$ is the action chosen by the receiver i. Ego_i is a

[10] The summary statistics of the results are reported in Appendix.

[11] We have power equal to 80.7%, to be more precise, fixing an average action of 4.99 in the non-ego-relevant condition.

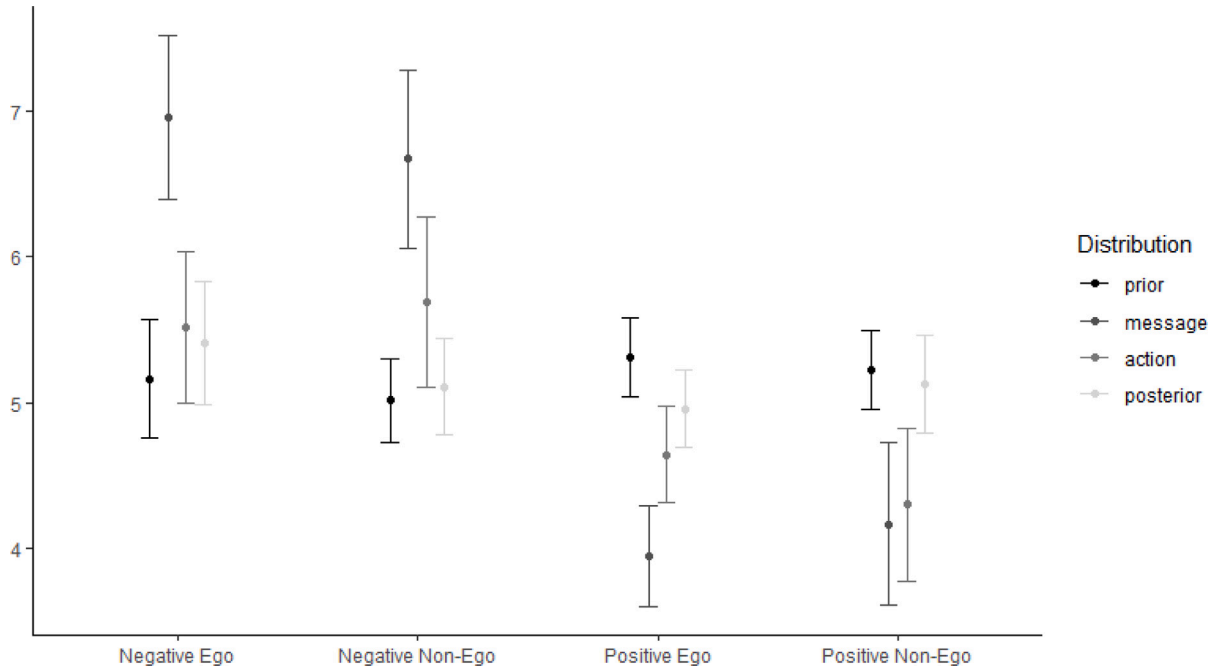

Fig. 6. Beliefs, actions, and messages. The figure reports the mean (with 95% confidence intervals) of the actions played, prior and posterior beliefs of the receivers, and the messages sent by the senders for each condition.

dummy equal to 1 if the receiver i plays in the ego-relevant condition. $Good/Bad\ News_i$, is a dummy equal to 1 if the difference between the prior belief of the receiver i (before he receives the message) on his own ranking and the message of the sender is strictly positive, in the positive conditions. It is equal to 1 if the difference between the message and the prior is strictly positive in the negative conditions. $Prior_i$ is the belief of the receiver i on his own ranking, before he receives the message. $Sdprior_i$ is the standard deviation of the receiver's beliefs. $\mathbf{x_i}$ is a vector containing controls about receiver i. Controls include demographics, and risk preferences. The Good/Bad News dummy allows us to study how subjects respond to messages that carry good or bad news. When this is equal to 1 in the positive conditions it corresponds to good news for the receiver, since the message received is lower than his prior. Hence, the sender is telling the receiver that he is better ranked than he thinks. Symmetrically, in the negative condition, a value of 1 corresponds to bad news. The sender is telling the receiver that he performed worse than he thinks and he is trying to persuade him to choose a higher action.

The results of regressions from Eqs. (1) and (2) are reported in Table 1. Several patterns emerge. First, we confirm that the ego relevance of the message does not lead to a significantly different response in the action of the receiver. The message of the sender has an effect on the action chosen by the receiver. When the receiver gets a message lower (higher) than his prior beliefs in the positive (negative) conditions ("Good/Bad News" dummy equal to 1), this leads to a chosen action of more than 2 rankings lower in the positive conditions, and almost 2 rankings higher in the negative ones. This means that the messages sent are not cheap-talk and the sender can actually influence the actions of the receiver, in order to maximize her own profit. However, the effects of the news is not significantly different in the ego relevant conditions with respect to the non-ego-relevant ones. In the Appendix, we show that the impact of the news is stable to two alternative definitions of it: (i) the intensive margin of news; (ii) using message and prior as separate regressors. Looking at the magnitude of the effect of the dummy Good/Bad News gives us the possibility to further validate our power analysis for the effect of ego-relevance. As we said, at standard power levels, we can detect a 0.71 effect of ego-relevance. This effect is one-third of the effect we find for the Good/Bad News dummy. This gives us confidence that we had power to detect even a relatively small effect of ego-relevance.

To address our second hypothesis, we focus on the posterior beliefs of the receivers. To elicit this, we elicit the entire probability distribution of the beliefs of the receiver on his own ranking, after he received the message from the sender. We will refer to the mean of this distribution as posterior belief, or posterior. This takes value of 4.96 (5.41) in the positive (negative) ego-relevant condition, and it takes value 5.12 (5.11) in the positive (negative) non-ego-relevant condition. From these figures we can already see that, while the difference between the positive ego and non-ego-relevant conditions goes in the expected direction, the difference between the negative ego and non-ego-relevant conditions goes in the opposite direction with respect to what we had hypothesized. More specifically, the posterior of the receiver is actually higher in the negative ego-relevant condition than in the non-ego-relevant one. We performed a one-sided t-test, with the following hypothesis:

$$H_0 : p_e \geq p_{ne} \quad H_1 : p_e < p_{ne}$$

where p_e is the posterior in the ego-relevant condition, and p_{ne} is the posterior in the non-ego-relevant one. In both the positive and the negative conditions, we could not reject the null hypothesis, with $p = 0.22$ and $p = 0.86$, respectively. We also performed the same test, by joining the negative and positive conditions. To be more precise, we tested if the average posterior in the two ego-relevant conditions is lower than the one in the two non-ego-relevant conditions. As above, this test can be performed given that the hypothesized ego effects would work in the same direction in the positive and the negative conditions. This means that motivated beliefs would make individuals believe to be of lower rank. In the positive (negative) ego-relevant condition this implies that receivers will be more (less) likely to believe low (high) messages compared to the non ego-relevant ones. The average posterior in the two ego-relevant conditions is 5.11 and the one taken in the two non-ego-relevant conditions is 5.12. We could not reject the null

Table 1
Action The dependent variable is the action of the receiver after receiving the message. Ego is a dummy equal to 1 for the ego-relevant condition. Good/Bad News is a dummy equal to 1 if the difference between the prior belief of the receiver (before he receives the message) on his own ranking and the message of the sender is strictly positive, in the positive condition. It is equal to 1 if the difference between the message and the prior is strictly positive in the negative condition. Sd prior is the standard deviation of the receiver's beliefs. Controls include demographics, and risk preferences of the receiver.

	Dependent variable:					
	Action					
	Positive condition			Negative condition		
	(1)	(2)	(3)	(4)	(5)	(6)
Ego	0.167	0.188	0.065	−0.318	−0.139	−0.448
	(0.302)	(0.519)	(0.529)	(0.380)	(0.466)	(0.523)
Good/Bad News	−2.076***	−2.054***	−2.250***	1.695***	1.824***	1.613**
	(0.262)	(0.554)	(0.596)	(0.285)	(0.490)	(0.508)
Prior	0.736***	0.736***	0.763***	0.906***	0.901***	1.002***
	(0.090)	(0.090)	(0.090)	(0.105)	(0.105)	(0.099)
Sd prior	0.005	0.005	0.006	0.012	0.011	0.027
	(0.028)	(0.028)	(0.028)	(0.036)	(0.036)	(0.035)
Ego ∗ Good/Bad News		−0.029	0.135		−0.229	−0.020
		(0.597)	(0.613)		(0.587)	(0.594)
Controls	NO	NO	YES	NO	NO	YES
Observations	196	196	196	121	121	121
R^2	0.338	0.338	0.355	0.373	0.373	0.429
Adjusted R^2	0.325	0.321	0.323	0.351	0.346	0.382

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; Robust s.e. in parenthesis.

hypothesis, with $p = 0.47$. To mitigate power concerns, we conducted an ex-post power analysis. We fixed the probability of false positive to the standard threshold, $\alpha = 0.05$. We reach the standard threshold of 80% power to detect a 0.46 difference between the ego and the non-ego-relevant conditions.[12] We will later argue that this is an effect of relevant magnitude.

As above, we now investigate this research question more carefully by running OLS regressions:,

$$Posterior_i = \alpha + \beta_1 Ego_i + \beta_2 Good/Bad\ News_i + \beta_3 Prior_i + \beta_4 Sdprior_i + \epsilon_i \tag{3}$$

$$Posterior_i = \alpha + \beta_1 Ego_i + \beta_2 Good/Bad\ News_i + \beta_3 Prior_i + \beta_4 Sdprior_i + \beta_5 Ego_i \times Good/Bad\ News_i + \boldsymbol{\delta}\mathbf{x_i} + \epsilon_i \tag{4}$$

We perform the analysis separately for the positive and the negative conditions. $Posterior_i$ is the posterior of receiver i. Everything else is defined as in Eqs. (1) and (2).

The results of regressions from Eqs. (3) and (4) are reported in Table 2. Several patterns emerge. First, this analysis confirms that the ego relevance of the message does not lead to a significant change in the posterior of the receiver. The message of the sender has an effect on the beliefs of the receiver. We can derive this by looking at the coefficient of Good/Bad news. When the receiver gets a message lower (higher) than his prior beliefs in the positive (negative) conditions ("Good/Bad News" dummy equal to 1), this leads to a posterior which is more than 0.8 rankings lower than in the positive condition. The effect is also present in the negative condition, but it disappears when we interact the Good/Bad News and the Ego dummies, and when we add controls. As it was the case for action, the effects of the news is not significantly different in the ego relevant conditions with respect to the non-ego-relevant ones. In the Appendix, we show that the impact of the news is stable to two alternative definitions of it: (i) the intensive margin of news; (ii) using message and prior as separate regressors. We can repeat the exercise we did to validate our power calculation for the impact of the Good/Bad News dummy on the action. We pointed out that, at standard power levels, we can detect a 0.46 effect of ego-relevance on posterior beliefs. We can compare this figure to the effect of Good/Bad News reported in Table 2. This effect, in the positive conditions, is much higher than 0.46, reaching an absolute value of 0.98 if we focus on column (1) of Table 2. This gives us confidence that we had power to detect even a relatively small effect of ego-relevance.

We also investigate whether subjects are overconfident. In Burro and Castagnetti (2022), we observed that senders expect the receivers to be overconfident in the ego relevant conditions. Overconfidence is defined as the difference between the actual ranking of the receiver and his own prior belief. We do find that this value is statistically significant from 0, in the two ego-relevant conditions. It is equal to 1.06 in the positive ego-relevant one and to 1.11 in the negative ego-relevant one. It is equal to 0.66 in the positive non-ego-relevant one and to −0.15 in the negative non-ego-relevant one. In all these cases we performed a t-test to test the hypothesis that overconfidence was different from 0. We could reject the null with $p < 0.01$ in both the ego-relevant conditions, while we could not reject the null (at the standard 0.05 threshold) in the two non-ego-relevant ones.

6 Discussion

We now discuss potential threats to the interpretation of the results. In doing so, we also provide supportive evidence of why they cannot convincingly account for the null effect of ego-relevance of the state on actions and posterior beliefs.

In the previous section, we looked at how receivers react to news depending on the ego-relevance of the state. It could be the case that subjects react differently to messages in the game and not to news itself. However, as shown in the Appendix, econometric analyses of the effect of messages on actions and beliefs find similar results. In sum, the main results are not driven by the way in which we analyze the information that is being socially transmitted.

It is often problematic to disentangle cognitive biases (i.e., due to cognitive constraints and limitations) from motivated biases. In particular, it is difficult to unravel the effects of confirmation bias (i.e., the tendency to put more weight on information that confirms

[12] We have power equal to 80.5%, to be more precise, fixing an average posterior of 5.12 in the non-ego-relevant condition.

Table 2
Posterior The dependent variable is the belief of the receiver on his own ranking after receiving the message. Ego is a dummy equal to 1 for the ego-relevant condition. Good/Bad News is a dummy equal to 1 if the difference between the prior belief of the receiver (before he receives the message) on his own ranking and the message of the sender is strictly positive, in the positive condition. It is equal to 1 if the difference between the message and the prior is strictly positive in the negative condition. Sd prior is the standard deviation of the receiver's beliefs. Controls include demographics, and risk preferences of the receiver.

	Dependent variable:					
	Posterior					
	Positive condition			Negative condition		
	(1)	(2)	(3)	(4)	(5)	(6)
Ego	−0.058	0.056	0.098	0.303	0.001	−0.101
	(0.171)	(0.257)	(0.247)	(0.183)	(0.202)	(0.208)
Good/Bad News	−0.981***	−0.862**	−0.806**	0.553***	0.336	0.276
	(0.159)	(0.263)	(0.274)	(0.150)	(0.224)	(0.232)
Prior	0.830***	0.831***	0.827***	0.866***	0.874***	0.908***
	(0.058)	(0.058)	(0.060)	(0.053)	(0.051)	(0.052)
Sd prior	−0.046*	−0.046*	−0.045*	−0.033	−0.032	−0.026
	(0.020)	(0.020)	(0.020)	(0.022)	(0.022)	(0.020)
Ego ∗ Good/Bad News		−0.161	−0.210		0.387	0.442
		(0.302)	(0.299)		(0.273)	(0.263)
Controls	NO	NO	YES	NO	NO	YES
Observations	196	196	196	121	121	121
R^2	0.576	0.576	0.579	0.662	0.665	0.678
Adjusted R^2	0.567	0.565	0.558	0.650	0.650	0.652

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; Robust s.e. in parenthesis.

one's prior beliefs relative to information that contradicts them) from those of motivated belief formation.[13] In this paper, confirmation bias cannot be confounded with motivated reasoning. Indeed, the research questions and experimental analyses are related to whether subjects are more (less) likely to believe "good" ("bad") news, which is defined as positive (negative) deviations from prior beliefs. Thus, in this environment there is little room for confirmation bias.

Furthermore, the ego-relevant treatments are about IQ ability. One may wonder whether the results in the ego-relevant treatments are dependent on IQ ability. In particular, it is possible that individuals of higher IQ ability are more likely to receive "good" news, or vice versa. Whereas in the non-ego-relevant treatments this is likely not to be the case. This would result in spurious treatment comparisons. However, we do not find strong evidence that the type of news received is significantly shaped by receivers' ranking. We run regressions of both the Good/Bad News dummy and the News variable on the ranking of the receiver in the positive, negative, and in the joint condition and the coefficient of ranking is always far from providing evidence of being a relevant regressor.

A final caveat relates to the difficulty of the IQ test implemented in the experiment. While the test was purposely chosen to avoid ceiling effects and discriminate across different levels of ability, the test difficulty may have contributed to a more constrained development of motivated beliefs. While this is a possibility, two considerations are worth emphasizing. First, similar difficulty levels of this test have been implemented in the literature that has identified ego-relevant motives (e.g., Castagnetti & Schmacker, 2022). Second, we do not find any significant result even if we run the analysis for those individuals who are relatively overconfident.

7 Conclusion

Theoretical work in economics has put forward reasons why subjects may end up with overconfident beliefs about their personal characteristics. These include motivational reasons (Bénabou & Tirole, 2002), self-esteem concerns (Köszegi, 2006), and anticipatory utility (Brunnermeier & Parker, 2005). Recent experimental literature has provided evidence of different mechanisms that allow individuals to interpret ego-relevant information self-servingly. Yet, in most of this work, information processing takes place in abstract settings in which there is no social exchange of information. Thus, there is much scope for work that studies the implications of ego-relevant concerns in economically relevant interactions.

In this paper, we conduct an experiment that fills this gap and that presents key features of many real-world economic relationships. In particular, here we study whether ego concerns leave individuals more easily fooled by others in a setting of strategic information transmission. To study this research question, the experimental design varies two relevant dimensions (ego-relevance and payoff incentives), resulting in a 2×2 factorial design. The findings of the experiment clearly show that the recipients of information are not more likely to be fooled when the messages they hear provide good news about their relative ability. In particular, subjects' actions in the game and their belief formation do not diverge depending on the ego-relevant content of the news, nor on whether the news carries positive or negative content.

To sum up, this research brings a new perspective to the literature on motivated belief formation. In particular, it shows that the desire to form favorable beliefs about oneself does not make individuals blind to the motives of the person who sends the information, at least in our setting. While in a similar environment (Hagenbach & Saucet, 2023) find evidence of insufficient skepticism, we show limits to motivated belief formation and, specifically, that this previously documented force does not necessarily arise in the context of strategic economic interactions. The findings presented here, therefore, are in line with the intuition of Bénabou and Tirole (2016), in which the supply side of motivated beliefs creates reality constraints that prevent individuals from freely forming their desired beliefs. To study this further, varying the supply side constraints would be useful to deepen our understanding of the forces that facilitate and limit the formation of motivated beliefs.

There are different avenues for future work. First, while we focus on strategic interactions exclusively, work could study the formation of ego-relevant motives across settings that involve strategic interactions and not. Second, different variations of our strategic interaction setting could be studied which could include the removal of common knowledge and that the interaction is repeated. Third, future research could study the implications of motivated belief formation in other economic interactions with the social exchange of ego-relevant information. These novel settings and derived insights would allow us to better understand how the demand and supply sides of motivated beliefs interact.

[13] This is particularly true in the asymmetric updating literature where the experimental signals are either positive or negative. The coarse structure of the signal structure makes it more difficult to disentangle confirmation bias from motivated beliefs.

CRediT authorship contribution statement

Giovanni Burro: Writing – review & editing, Writing – original draft, Software, Investigation, Formal analysis, Data curation. **Alessandro Castagnetti:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data are on Mendeley. They are available at this link: https://data.mendeley.com/drafts/mgghc39cd6 We included the link in the article.

Statements and declarations

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Data and code are available here.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.socec.2024.102167.

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