Protecting the Ego: Motivated Information Selection and Updating*

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Abstract

This paper investigates how individuals search for ego-relevant information and how they subsequently update their beliefs. In a lab experiment, participants are ranked according to either their performance in an IQ test (ego-relevant treatment) or a random number (control treatment). Subjects are incentivized to report their beliefs about whether their IQ score or their random number is in the top half of the distribution. We ask for both prior and posterior beliefs after three rounds of signals. Before the updating stage, subjects choose between information sources that vary in terms of informativeness, skewness and framing. Moreover, in a further treatment we exogenously assign subjects an information structure to investigate their updating behavior absent selection. Our results show, first, that subjects are significantly more likely to choose information structures that are less informative and positively framed if the rank is based on the ego-relevant task. Second, we find that subjects in the ego-relevant treatment update less to negative feedback but only when feedback is positively framed, i.e., when it is easier to misperceive the negative feedback. Taken together, we document that, in the IQ treatment, subjects choose information structures that allow them to selectively underweigh negative feedback. Thus, we provide evidence of a novel mechanism that explains how individuals can maintain self-serving beliefs.

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1 Introduction

There is an abundant literature showing that people have self-serving beliefs about ego-relevant characteristics, e.g., the vast majority believes to be in the top half of any kind of skill distribution.[1] The reasons for the desire to hold inaccurate beliefs can be manifold and range from pure ego-utility (Köszegi, 2006) to motivational purposes (Bénabou and Tirole, 2002).[2] However, the observation that many people have overconfident beliefs about their personal characteristics is hard to square with the fact that they receive continuous feedback from their surroundings. While the literature has so far studied how overconfidence can derive from biased belief formation (in terms of feedback processing and recall), here we are interested in an overlooked but potentially important mechanism: how people selectively choose between different information sources from which to receive ego-relevant information.

In fact, it is often the case that individuals do not only passively receive feedback but, instead, selectively choose from which source to receive news about themselves. This choice is important since informational sources critically vary in the information they provide and the way the feedback is framed. Standard models predict that individuals have a strict preference for choosing the most informative feedback source because this choice leads to holding accurate beliefs and, thus, in making better-informed decisions. However, when individuals have motivated beliefs (i.e., a desire to hold a positive self-view) about being of high ability, they may prefer to receive information from less informative feedback structures, for instance, to avoid adjusting their beliefs downward. Moreover, people may care about the framing of the feedback, as opposed to the predicted indifference in standard models, as it may allow individuals to more easily interpret the underlying informational content in a self-serving way.

In this paper, we ask: (1) do individuals selectively choose information structures in order not to impair their views about their ability? Moreover, given that the subsequent belief formation process can be shaped by the characteristics of the information structure, we ask: (2) is the subsequent belief updating process affected by the information structure chosen?

To answer our research questions, we conduct the following lab experiment. Subjects are asked to form beliefs about the probability to be in the top half of a distribution. We exogenously vary in a between-subject design whether the rank in the distribution is ego-relevant or not by letting it be based on either: (1) their performance in an IQ test, or (2) a randomly drawn number. First, we elicit participants' prior beliefs to be in the top half of the distribution. We then give subjects three consecutive (noisy) signals informing them whether

[1] See the surveys in Bénabou and Tirole (2016); Alicke and Govorun (2005); Moore and Healy (2008).

[2] Von Hippel and Trivers (2011) argue that self-deception and overconfidence evolved as an interpersonal strategy to gain a strategic advantage to persuade others. This conjecture is experimentally supported by Schwardmann and Van der Weele (2019), Solda *et al.* (2019), and Smith *et al.* (2017). However, holding inaccurate beliefs about ability is also costly in many domains, e.g., it leads to suboptimal management decisions (Malmendier and Tate, 2005) or over entry into competition (Camerer and Lovallo, 1999).

they are in the top half of the distribution. After each signal, we elicit the corresponding posterior belief.[3] Importantly, before the updating stage, subjects make five pairwise choices between information structures that vary in informativeness, framing, and skewness. Informativeness describes by how much beliefs are shifted by a given signal. Framing refers to the way in which positive and negative signals are transmitted, holding informativeness constant. Skewness describes if an information structure is more or less informative depending on the subject being above or below the median. Intuitively, subjects who want to protect their ego may choose an information structure that is less informative, positively framed, and positively skewed even if this comes at the cost of forming less accurate posterior beliefs.

In the analysis we first compare the information structure choices across treatments. Second, we investigate belief updating compared to both the Bayesian benchmark and across information structures and ego-relevance of the rank. Since updating is endogenous to the chosen information structure, our experiment also features a treatment in which subjects are exogenously placed into one of the information structures.

Our experimental findings show a stark difference in the way individuals seek for information depending on whether the rank is ego-relevant or not. In particular, subjects are more likely to choose less informative and positively framed information structures when the ego is at stake. In contrast, the results do not support the notion that individuals choose information structures that are positively skewed to protect their ego. Our findings are supported by looking at information structure choices separately, as well as the within-individual choice patterns. Moreover, we find that subjects, who are classified as information avoiding according to the Information Preference Scale by Ho *et al.* (2018), are more likely to choose an information structure that is less informative and positively framed.[4]

Moreover, we five that the subsequent belief updating process is heavily influenced by the chosen information structure. This is because individuals' updating behavior deviates more strongly from Bayes' rule when the negative signals are framed as neutral signals, but only when the signals carry valenced information. We find first indication for this in the Endogenous treatment, where subjects receive signals from the information structure they selected into. The results are corroborated by our Exogenous treatment, in which subjects are placed into information structures, which eliminates potential selection issues. Thus, we find that subjects update asymmetrically to ego-relevant signals, but only when the framing of the signals allows them to. In contrast, when signals are not ego-relevant, the same signal structure does not lead to asymmetric updating.

Our results illustrate how a desire to protect one's ego (i.e., the demand side) interacts with the supply-side and its reality and feedback constraints (Bénabou and Tirole, 2016).

[3]We elicit beliefs in an incentive compatible fashion and randomly choose one belief elicitation for payment.

[4]We do not find evidence for heterogenous information preferences by gender, cognitive ability, or prior belief.

That is, when the feedback information leaves sufficient space to interpret the information more conveniently, individuals' belief formation is biased. The interplay of both the demand side and reality constraints, specifically in terms of the framing of the feedback, which have been overlooked until now, is a mechanism that leads people to hold inaccurate beliefs about one's own abilities and fuels up overconfidence. In fact, our results show that subjects, who receive feedback from the less informative and positively framed information structure, maintain overconfident beliefs about their intelligence. In contrast, subjects who receive balanced feedback are on average not overconfident about their rank anymore at the end of the experiment.[5]

The treatment variation in the ego-relevance of the state allows us to distinguish cognitive biases – general systematic errors in thinking that affects how people search and process new information – from motivated biases – biases that are driven by a desire to hold positive views of oneself. In the discussion section, we argue that the treatment differences cannot be explained by cognitive biases like confirmation- or contradiction-seeking behavior, differences in cognitive ability or confusion about the experimental design.

Our findings on motivated information selection contribute a so far overlooked mechanism to the burgeoning literature in economics that studies the production and maintenance of self-serving beliefs. Bénabou and Tirole (2016) claim that when self-relevant beliefs are involved, people tend to process information differently depending on its valence and in terms of attention, interpretation and memory. For instance, people tend to ignore or discount negative news, while more readily incorporate good news into their (posterior) beliefs. However, the resulting experimental evidence on this mechanism – asymmetric updating – is mixed.[6] On the one hand, Eil and Rao (2011), Möbius *et al.* (2014), and Charness and Dave (2017) have found positive asymmetry. While, on the other hand, some studies have either found no asymmetry (Grossman and Owens, 2012; Schwardmann and Van der Weele, 2019; Gotthard-Real, 2017; Buser *et al.*, 2018) or even the opposite asymmetry (Ertac, 2011; Kuhnen, 2015; Coutts, 2019). Moreover, in a paper related to how cognitive errors can be driven by motivated beliefs, Exley and Kessler (2019) finds that people update their beliefs based on completely uninformative signals but only when the signals carry positive information and the updating state is ego-relevant. Our paper contributes to this literature since we find that asymmetric updating do arise in the ego-relevant treatment, but only when the information structure is framed in a way that allows to interpret the signals in a self-serving way.

[5] Balanced feedback in our setting describes an information structure, which is neither positively nor negatively skewed and in which both positive and negative signals are framed correspondingly.

[6] Selective recall of ego-relevant feedback has been documented in the experiments by Chew *et al.* (2019) and Zimmermann (2019). Both papers find that negative feedback on IQ test performance is more likely to be forgotten as compared to positive feedback.

We also contribute to the literature on information avoidance.[7] Eil and Rao (2011) and Möbius *et al.* (2014) present experimental evidence that a significant proportion of subjects who have received prior noisy information regarding their relative rank in an ego-relevant task (i.e., intelligence and attractiveness) have negative willingness to pay for having their rank fully revealed. However, there are relevant differences with our study. First, in our study subjects "choose" the signals that they would like to receive before any feedback is given. Hence, we identify more subtle preferences about information where information is still open to interpretation. In our experiment, subjects can still remain in denial, while in the previous experiments information fully revealed the state. Second, we do not only look at preferences for information avoidance, but we also seek to learn how individuals' preferences for information structures depend on their skewness and framing. Finally, we aim to understand if there are systematic interactions between information source selection and updating behavior. In particular, our goal is to learn if and how motivated source selection interacts with belief formation leading to biased updating and overconfidence.

Our results also relate to an emerging literature that studies how complexity in the environment influences belief updating. Epstein and Halevy (2019) find that when the complexity of the signal structure increases (i.e., the signals are ambiguous instead of risky), deviations from Bayes rule are greater. In a different context, Fryer *et al.* (2019) experimentally show that individuals interpret ambiguous signals in the direction of their prior beliefs and subsequently form biased posterior beliefs. Moreover, Enke and Zimmermann (2017) show that when signals are correlated, many individuals are prey to the double-counting problem. Similarly, Enke (2017)'s results illustrate that individuals find it difficult to make inferences from the absence of signals. In a strategic environment, Jin *et al.* (2018) find that senders are less likely to disclose unfavorable information and receivers are too trustful about undisclosed messages. However, as opposed to this literature, we look at how the informativeness and the framing of the signals affect updating. Moreover, by varying the ego-relevance of the state in a between-subject design, we can analyze the connection between cognitive and motivated biases in updating that depend on differences across information structures.

Finally, our research contributes to a recent literature on information structure selection. Within this literature, several papers have studied preferences about the timing and skewness of information disclosure in settings where information structures do not have any instrumental value (Falk and Zimmermann, 2016; Zimmermann, 2014; Nielsen, 2018). For example, Masatlioglu *et al.* (2017) find that individuals have a preference for positively skewed information structures, i.e., information structures that resolve more uncertainty regarding the desired outcome than the undesired one. Closer to our setting, some recent experimental

[7] For a review of the information avoidance literature, see the survey by Golman *et al.* (2017). In the health domain, Oster *et al.* (2013) and Ganguly and Tasoff (2016) provide empirical evidence that people avoid medical testing. In a financial context, Karlsson *et al.* (2009) and Sicherman *et al.* (2015) show that investors check their portfolios less often when the market is falling.

papers have also studied preferences over information structures in settings where information has instrumental value. Charness *et al.* (2018) and Montanari and Nunnari (2019) study how people seek information from biased information structures. The findings of both papers show that a significant fraction of individuals make suboptimal information structure choices. Differently from these papers, however, our goal is to understand how the sub-optimality of information acquisition is driven by ego-relevant motives.

The remainder of the paper is organized as follows. In Section 2, we describe our experimental design consisting of two treatment variations: ego-relevance of the rank and endogenous/exogenous information structure allocation. In Section 3, we present our experimental results. First, we study how participants select their preferred information structures depending on the ego-relevance of the rank. Second, we study subsequent belief updating. In section 4, we discuss our findings and, in particular, we rule out cognitive biases as an alternative explanation for our main results. Finally, in Section 5, we conclude.

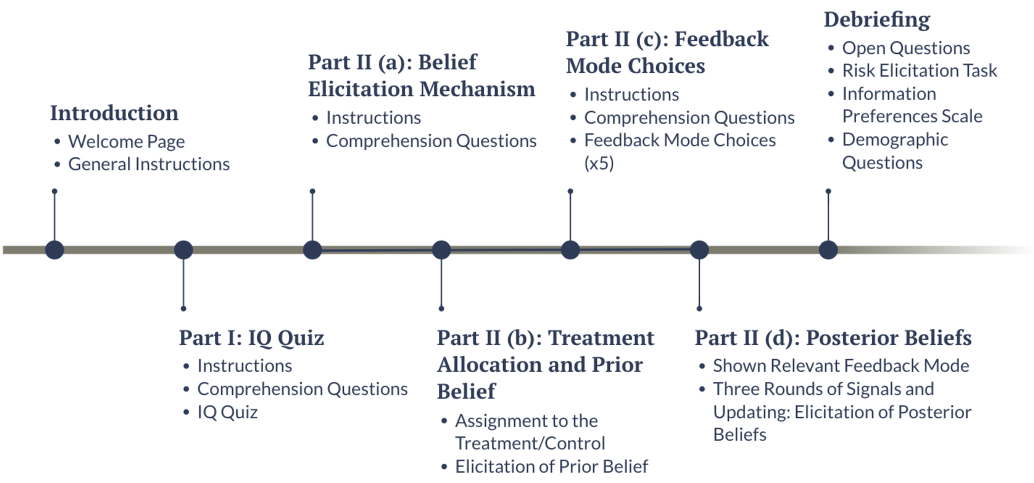
2 Experimental Design

To investigate if individuals choose information structures to protect their ego, we design an experiment that contains (1) exogenous variation in ego-relevance of beliefs, (2) choices between varying information structures, and (3) elicitation of updating behavior within different information structures. In a between-subject design we vary, on the one hand, if subjects receive feedback about their relative rank in IQ test performance (IQ treatment), or about a random number (Random treatment). On the other hand, we vary if subjects receive signals from the information structure they selected into (Endogenous treatment), or from an information structure they are exogenously assigned to (Exogenous treatment).

Figure 1 gives an overview of the experiment. The experiment consists of two parts, of which only one is randomly selected for payout. In Part I, subjects are paid for their performance in an IQ test. They have 10 minutes to solve 20 matrices from the Raven Advanced Progressive Matrices (APM) test. They can earn £2.00 per correct answer out of three randomly chosen matrices. Although in Part II the IQ performance is only relevant for subjects in the IQ treatment, all subjects solve the IQ quiz in Part I. Thereby, we ensure that there are no systematic differences in fatigue, timing and earnings between treatments.

In Part II, subjects are incentivized to give their belief about the state of the world, which is either related to their rank in the IQ test (IQ treatment) or related to the draw of a random number (Random treatment). First, in Part II (a), we explain subjects the matching probabilities method (Karni, 2009), which ensures that subjects maximize their chance to win a prize of £6.00 by stating their true belief (see Appendix B). In Part II (b), subjects give their prior belief about either their IQ performance rank or their random number depending on the treatment they are in (see Figure G.7 for a screenshot). Afterwards, in Part II (c),

Figure 1: Timeline of the Experiment



subjects in the Endogenous treatment choose from which information structure (feedback mode) they would like to receive signals. Finally, in Part II (d), there are three rounds of feedback and we elicit posterior beliefs. One out of the four belief elicitations is randomly selected for payout.

Since subjects are incentivized to give their true belief, a payoff-maximizing subject would always choose the most informative information structure and update according to Bayes rule. However, in the IQ treatment, the motive to maximize payout can be in conflict with the motivated desire of not hurting one's own beliefs about one's (relative) ability. For instance, subjects may forego expected payoff in order not to impair their beliefs of being of high intelligence. If that is the case, we expect a treatment difference in information structure selection and/or updating behavior depending on whether the beliefs are ego-relevant or not. In line with the experimental literature on motivated beliefs, we assume that further deviations from the rational benchmark are constant between IQ and Random treatment (this assumption is discussed in Section 4).

2.1 IQ and Random Treatment

We vary the ego-relevance of beliefs by randomizing subjects into an IQ treatment and a Random treatment. Randomization is performed at the session level. In accordance with the treatment, subjects are told at the beginning of Part II whether we will ask for their beliefs about the IQ performance or the random number. Consistent with previous research, we argue that rank in the IQ treatment is ego-relevant (e.g. Eil and Rao, 2011). Moreover, to increase the ego-relevance of the IQ treatment we explicitly told subjects that the APM test is commonly used to measure fluid intelligence and that high scores in this test are regarded as a good predictor for academic and professional success, occupation, income, health, and longevity (Sternberg *et al.*, 2001; Gottfredson and Deary, 2004).

2.1.1 IQ Treatment

In the IQ treatment, we informed subjects that the second part of the experiment was related to their relative performance in the IQ test they completed in Part I. Specifically, they were told that the computer has divided participants in their session into two groups: one group consisting of those subjects whose score was in the top half of the scores' distribution and those whose score was in the bottom half. Subjects learned that their task was to assess whether their IQ performance was in the top or bottom half of the distribution as compared to all other subjects in their session.

2.1.2 Random Treatment

In the Random treatment, instead, we informed participants that the second part of the experiment would consist of the following task. We told subjects that the computer has randomly drawn a number between 1 and 100. This random number was shown to them. We also informed them that three other numbers between 1 and 100 (with replacement) had been drawn. However, these numbers were not shown to them. Hence, they were told that their task was to assess whether the shown number was in the top or bottom half of the distribution among these four numbers.[8] The four numbers were randomized at the individual level. Thus, the task was purposely designed to have variation in prior beliefs. In this way, we could ensure that the distribution is not degenerate and the distribution of prior beliefs in the Random treatment more closely resembles that of the IQ treatment.

2.2 Information Structure Selection

2.2.1 Feedback Modes

Table 1 shows the information structures in the experiment. Information structures consist of two urns with ten balls each. A ball drawn from an urn in the selected information structure constitutes a signal. If an individuals' IQ score or random number is in the top (bottom) half of the distribution, balls are drawn from the upper (lower) urn with replacement. Every subject receives three independently drawn signals from the respective urn.

Depending on the information structure, subjects can receive up to three different types of (noisy) signals. Figure G.1 displays how the possible signals are introduced in the instructions. Subjects in the IQ (Random) treatment can either receive a green signal with the description "You are in the top half" ("Your number is in the top half"), a red signal with the description

[8] For both conditions, subjects were informed that ties would be broken randomly.

"You are in the bottom half" ("Your number is in the bottom half"), or a grey signal with the description "...". On the same page, we explain subjects that the meaning of the respective signal depends on the feedback mode and the state (see Figure G.3 for a screenshot). For example, subjects are told that in Feedback Mode A, they are more likely to get the green signal if they are in the top half of the distribution and that they are more likely to get the red signal if they are in the bottom half of the distribution.[9] In all feedback modes, the green signal increases the posterior to be in the top half and the red signal increases the posterior to be in the bottom half. However, depending on the feedback mode, the grey signal can constitute positive, negative or non-informative feedback, which allows us to vary the framing of feedback.

Information structures differ in their informativeness, skewness and framing. The informativeness of signals in our experiment can be described, first, by their likelihood ratio (LR) and, second, by the probability to get a non-informative signal. Both of these properties are given in the bottom panel in Table 1. The further away from one the likelihood ratio is, the more informative is the signal and the more it shifts the posterior belief of a Bayesian updater (e.g. the negative signal in Mode A is more informative than the negative signal in Mode B).[10] The probability to receive a non-informative signal only applies to Modes A and D where grey signals are not informative (hence, Mode A is more informative than D).

We call an information structure positively skewed if the positive signals are more informative than the negative signals (as in Mode B and E) and negatively skewed if the negative signals are more informative (as in Mode C). An information structure is symmetric if positive and negative signals are equally informative (as in Mode A and D).

Finally, information structures differ in the framing of signals. We call a feedback mode positively framed if negative feedback is illustrated by grey signals (as in Mode B) and negatively framed if positive feedback comes in the form of grey signals (as in Mode C and E). An information structure has a balanced framing if positive signals are green balls, negative signals are red balls and non-informative signals are grey balls (as in Mode A and D).

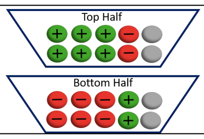
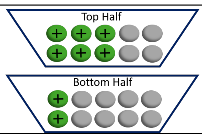
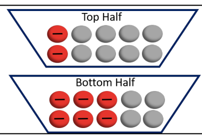
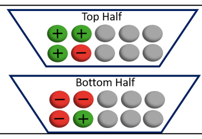
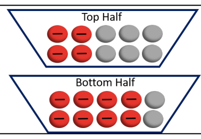
2.2.2 Feedback Mode Choices

We let subjects make five pairwise choices (which we call "scenarios") between information structures. By carefully varying the information structures to choose from, we are able to elicit if subjects have preferences for informativeness, framing, and skewness when information is ego-relevant or not. Every subject makes all five choices. They are told that one of these

[9] In the Endogenous treatment, we explain these characteristics by always using one feedback mode choice as an example. We use three different examples, as illustrated in Figures G.3 to G.5, and check if these matter for choices in Appendix D. In the Exogenous treatment, we explain the signals using the feedback mode the participant is assigned to, see the screenshot in Figure G.6.

[10] In fact, a likelihood ratio of one implies that the signal is fully uninformative about the underlying state.

Table 1: Feedback Modes

Mode A	Mode B	Mode C	Mode D	Mode E
				
LR(Top|Green)=3 LR(Top|Red)=1/3 Prob(No Info)=1/5	LR(Top|Green)=3 LR(Top|Grey)=1/2 Prob(No Info)=0	LR(Top|Grey)=2 LR(Top|Red)=1/3 Prob(No Info)=0	LR(Top|Green)=3 LR(Top|Red)=1/3 Prob(No Info)=3/5	LR(Top|Grey)=3 LR(Top|Red)=1/2 Prob(No Info)=0

Notes: Table shows the feedback modes that can be selected in the experiment. Depending on the state (top or bottom half), a signal is drawn from the upper or lower urn. LR(State|Signal) describes the likelihood ratio of the signal concerning the state. Prob(No Info) describes the probability to receive a non-informative signal.

five pairwise choices will be randomly selected, and the information structure chosen in that comparison will be implemented for feedback.[11]

Baseline Choice: Mode A vs Mode B In the Baseline choice, we make subjects choose between two feedback modes that vary in informativeness, skewness and framing. First, Mode A is more informative than Mode B. Second, while Mode A gives balanced positive and negative feedback depending on the state, Mode B is positively skewed and is positively framed (i.e., the negative feedback is framed as grey signals). Hence, if more subjects choose Mode B in the IQ treatment compared to the Random treatment, we can interpret this as evidence that subjects aim to protect their ego by choosing an information structure that gives less informative and positively skewed signals with a positive framing. Using the next choices, we aim to disentangle the underlying preferences for skewness, informativeness, and framing.

Informativeness Choice: Mode A vs Mode D First, individuals might have a preference for less informative feedback structures if information is ego-relevant. The choice between Mode A and D isolates a preference for informativeness since only the probability to receive an uninformative grey signal varies.

Framing Choice: Mode B vs Mode E Second, there could be a preference for framing, e.g. framing negative feedback as grey signals if information is ego-relevant. Such a preference could be due to simple aversion against explicit negative feedback, but also due to the anticipation of differential updating behavior (cf. results on updating in Section 3.2). In order to test for framing preferences, we let subjects choose between Mode B and Mode E, which have the same informativeness and skewness but only differ in framing (positive signals are green in B and grey in E, and negative signals are grey in B and red in E).

[11] In order to control for order effects, we vary the order of information structures as discussed in Appendix D.

Skewness over Framing Choice: Mode A vs Mode E Third, individuals could prefer to receive positively skewed information, i.e. information structures where positive signals are more informative than negative ones. We investigate the relative importance of preferences for positive skewness over preferences for positive framing by letting subjects choose between Mode A and Mode E. While the positive (grey) signals in Mode E have a higher likelihood ratio than the negative (red) signals, Mode E is negatively framed (positive signals are grey and negative signals red). Since Modes A and E do not only vary in skewness but also in framing and informativeness, to get at a preference for positive skewness, in the analysis we will look at this choice together with our baseline choice. Thus, if subjects have a stronger preference for positive skewness than an aversion against negative framing, they would choose Mode E over Mode A and Mode B over A in our Baseline choice.

Baseline Reversed Choice: Mode A vs Mode C Finally, we also check if individuals have a preference for or against a negatively skewed information structure with negative framing (Mode C). The signals in this information structure are equally informative about being in the bottom half of the distribution but less informative about being in the top half as compared to Mode A.

2.3 Updating Behavior: Endogenous and Exogenous Treatment

Besides information structure selection, we also analyze the updating behavior of subjects and how it interacts with the feedback mode. In the updating stage, subjects received three consecutive signals from one of the feedback modes. After each signal received, subjects were asked to report their (posterior) beliefs.[12] Also, each time they received a signal and were asked their beliefs, subjects could display a picture of the feedback mode urns from which they were receiving information by clicking a button (see Figure G.2 for a screenshot of the choice situation).

How the feedback mode is determined, from which they receive signals, depends on whether they are in the Endogenous or the Exogenous treatment.

2.3.1 Endogenous Treatment

In the Endogenous treatment, one out of the five feedback mode choices explained above was randomly selected. The information structure that the subject has selected in the respective choice became relevant for updating. Before receiving signals, each subject was shown the choice she made in that scenario and the corresponding feedback mode from which she would be receiving information.

[12] Depending on the condition they were assigned to, they were asked to report their beliefs regarding their IQ scores (IQ treatment) or their number (Random treatment) being in the top half of the distribution.

2.3.2 Exogenous Treatment

In the Exogenous treatment, subjects are not asked to choose from which feedback mode to receive feedback, but are exogenously assigned to one. In particular, following the IQ test, subjects are randomly allocated to receive ego or non-ego relevant feedback from Mode A or Mode B.

The reason why we need the Exogenous treatment in addition to the Endogenous treatment to analyze updating behavior is twofold. First, given that subjects are randomly allocated into the feedback modes, random assignment guarantees that there are no systematic differences across groups, whereas in the Endogenous treatment subjects self-select into feedback modes. Due to this self-selection, subjects in different feedback modes have, on average, different preferences over information structures. This, in turn, could drive differences in updating behavior. Second, the Exogenous treatment allows us to evenly allocate subjects into the feedback modes and across ego-relevance of the rank. Hence, in the Exogenous treatment we have more statistical power to analyze differences in updating between feedback modes.

Our main interest is in understanding deviations from Bayes rule across feedback modes and by ego-relevance of the task. Our aim is to disentangle cognitive biases from motivated biases in updating. For this reason, we specifically focus on Feedback Modes A and B and their interaction with the ego-relevance of the task. In particular, a comparison in updating behavior across Feedback Modes A and B in the Random treatment will allow us to understand if differences in the information structure drive cognitive biases. While a comparison between updating across ego-relevant conditions will allow us to get at motivated biases in updating.

Importantly, as far as the updating stage is concerned, except for the random assignment into the feedback mode, there are no differences in the experimental design nor implementation between the endogenous and exogenous treatments. In this way, analyzing treatment differences in belief formation will permit us to also study if and how selection affects updating.

2.4 Debriefing

In the last part of the experiment, we asked subjects a battery of questions. First, we asked subjects to answer two questions in free-form text. In the former, we asked them to explain their motives behind the way they chose the feedback modes across the five scenarios. In the latter, we asked them to provide advice to a hypothetical subject who would be performing the feedback mode choices and updating task.[13] For these questions, we told subjects that they would be paid £0.50 for their answers. Second, we asked subjects to complete the Gneezy and Potters (1997) risk elicitation task. Specifically, each subject received £1.00 and had to decide how much of this endowment to invest in a risky project with a known

[13] In the Exogenous treatment, we only asked this latter open-text question.

probability of success. In particular, the risky project returned 2.5 times the amount invested with a probability of one-half and nothing with the same probability. Third, we asked subjects to complete the Information Preferences Scale by Ho *et al.* (2018), which is a 13-item questionnaire that measures an individual's desire to obtain or avoid information that has an instrumental value but is also unpleasant. The scale measures information preferences in three domains: consumer finance, personal characteristics, and health. Finally, we asked subjects a series of demographic questions such as age, gender and nationality. We also asked them a non-incentivized general willingness to take risks question (Dohmen *et al.*, 2011).

2.5 Experimental Procedure

The experimental sessions were conducted from June to October 2019 at the Economics laboratory of Warwick University. Overall, 445 subjects, recruited through the Sona recruitment system, took part in the experiment. In total, we conducted 14 sessions (216 subjects) for the Endogenous treatment and 15 sessions (229 subjects) for the Exogenous treatment. Sessions lasted on average 60 minutes. Participants earned an average payment of £11.00 including the show-up fee of £5.00. We conducted the experiment using oTree (Chen *et al.*, 2016). Descriptive statistics of the sample are provided in Table A.1.

In each session, subjects were randomly assigned a cubicle and general instructions were read aloud. The remaining instructions were provided onscreen. In both the endogenous and exogenous sessions, it was randomly determined whether the cubicle belonged to the IQ or Random treatment. Moreover, in the Exogenous treatment, it was randomly determined if the cubicle was allocated to Feedback Mode A or B.

3 Results

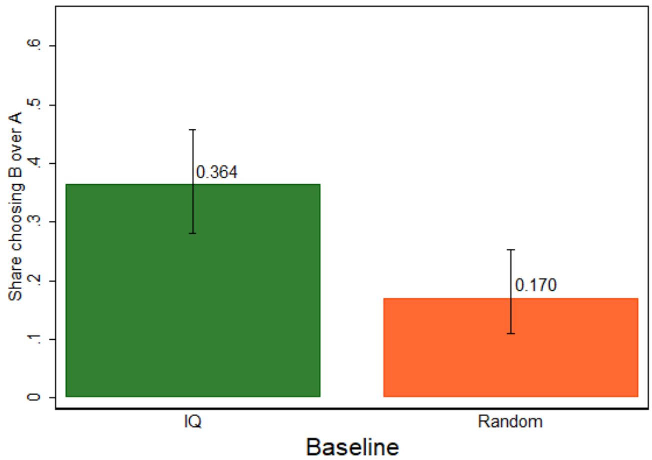
Our analyses proceed in two steps: First, we investigate treatment differences between IQ and Random in feedback mode choices. Second, we analyze how subjects update in response to signals from the corresponding feedback mode. We analyze updating in both the Endogenous treatment, where subjects select into feedback modes, and in the Exogenous treatment, where subjects are assigned to a feedback mode.

3.1 Information Selection

Information structures in our experiment differ in informativeness, skewness, and framing. The Baseline choice is the choice between Mode A and Mode B, which varies in all three of these dimensions. While Mode A gives balanced feedback, Mode B produces less informative, positively skewed signals with a positive framing. Hence, the choice of Mode B is costly because it provides less information and subjects are paid based on the accuracy of their posterior beliefs.

Figure 2 illustrates the percentage of subjects who prefer to receive signals from Feedback Mode B over Feedback Mode A. While only 17.0 percent of subjects in the control treatment choose Mode B over Mode A, 36.4 percent in the IQ treatment prefer Feedback Mode B. The resulting difference of 19.4 percentage points is statistically significant ($t(214) = 3.278, p = 0.001$).

Figure 2: Share choosing Feedback Mode B over A in Baseline Choice



Notes: Plot shows the fraction of subjects who prefer Feedback Mode A over Feedback Mode B in the Baseline Choice by treatment. 95% confidence intervals (Wilson) are shown by bar. In the IQ treatment there are N=110 subjects and in Control N=106.

In order to disentangle preferences for informativeness, skewness, and framing, we elicit subjects' preferences over information structures in four additional choices. Figure 3 plots the results. In the Informativeness Choice, subjects can choose between Mode A and Mode D, where both give balanced feedback but where Mode D is less informative than Mode A. The top left panel of Figure 3 shows that a higher proportion of subjects in IQ choose the less informative Feedback Mode D over Mode A. The difference of 13.5 percentage points is significant ($t(214) = 3.149, p = 0.002$). Hence, the results suggest that subjects in the IQ treatment have indeed a preference for less information compared to subjects in the Random treatment.

In the Framing Choice, subjects choose between the positively framed Mode B and the negatively framed Mode E. We find that in the IQ treatment significantly less subjects prefer the negatively framed feedback mode over the positively framed one, compared to the Random treatment (difference of 26.5 percentage points, $t(214) = 4.116, p < 0.001$). Since the informativeness and skewness of the feedback modes are held constant, we expect subjects in

Random to be indifferent. And indeed, the share of 52.8 percent choosing Mode E in Random is not significantly different from 50 percent ($t(105) = 0.581, p = 0.563$). In contrast, in IQ only 26.4 percent choose Mode E, which is significantly lower than the 50 percent that are predicted by indifference ($t(109) = 5.601, p < 0.001$). Hence, we infer that people care about the framing of signals when it concerns ego-relevant information.

In the Skewness over Framing Choice, we give subjects the choice between Feedback Mode A and Mode E. Mode E gives – just as Mode B – positively skewed information but is framed negatively. We find that in the IQ treatment fewer subjects prefer Mode E over Mode A than in the Random treatment. Taken together with our finding from the Baseline Choice, we conclude that subjects have a stronger preference against negative framing as they have a preference for positive skewness when information is ego-relevant. While in Feedback Mode B positive feedback comes in the form of green signals and negative feedback in the form of grey signals, in Feedback Mode E positive feedback is given in the form of grey signals and negative feedback as red signals. This difference in framing is enough to overturn the treatment difference from the Baseline choice, which suggests that the preference for positive skewness is not as strong as the preference for positive framing.

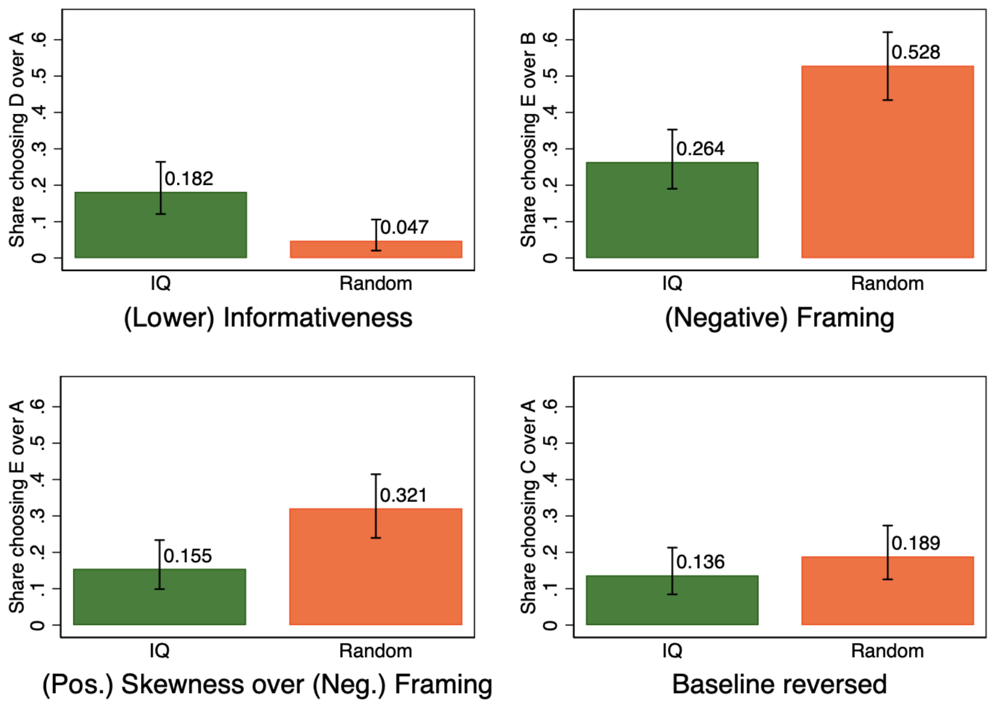
Finally, in the Baseline Reversed Choice, we let subjects decide between Feedback Mode A and Feedback Mode C. Mode C gives less informative, negatively skewed signals with a negative framing. In contrast to the Baseline Choice, we do not find a significant difference between treatments with less subjects in IQ choosing Feedback Mode C (difference of 5.2 percentage points, $t(214) = 1.041, p = 0.299$). This result suggests that subjects do not prefer less informative feedback modes in the IQ treatment if the feedback mode is negatively framed and negatively skewed.

In Table A.2 in the Appendix, we regress the five feedback mode choices on the IQ treatment dummy and different control variables. Controlling for demographics, prior beliefs, score in the IQ test, and risk preferences does not alter the results in terms of treatment differences in feedback mode choices.

3.1.1 Information Selection - Within Individual

Until now, we have looked at each choice separately and analyzed what we can learn from these individual choices. We now take advantage of the fact that we have multiple feedback mode choices per subject. To perform this within-analysis, we suppose that each subject has a fixed preference over information structures (conditional on the treatment) and chooses information structures according to this preference. In line with our experimental design, we focus on three preferences for information structures: maximize the informativeness, seek

Figure 3: Share choosing Feedback Modes in the respective choices



Notes: Plot shows the fraction of subjects who prefer one feedback mode over the other in the respective choice by treatment. 95% confidence intervals (Wilson) are shown by bar. In the IQ treatment there are N=110 subjects and in Control N=106.

positive skewness, and avoid negative framing. We estimate the fraction of subjects who consistently choose information structures that conform with these preferences.[14]

First, we calculate the fraction of subjects that makes choices according to each of these preferences and the fraction of subjects that makes choices that do not conform with one of these preferences. Second, we allow subjects to make mistakes and estimate which of the preferences can best explain subjects' choice patterns using maximum likelihood. Hence, we estimate the share of preference types and the amount of implementation noise (γ) necessary to classify subjects to one of the preferences. The estimation strategy follows Dal Bó and Fréchette (2011) and is described in detail in Appendix C.

In Table 2, we compare the relative prevalence of the implied preferences by treatment. In the first two columns, we present the empirically observed fraction of subjects who adhere to a given preference when they are not allowed to make mistakes. In the third and fourth column, we show the estimated fractions using maximum likelihood. Note that 26.4 percent of subjects in the IQ and 36.8 percent in the Random treatment are not classified if we do not allow for mistakes. In contrast, by using maximum likelihood we assign every subject the preference that describes her choice pattern best.

First, consider the strategy to maximize the informativeness of information structures. There are fewer subjects who consistently maximize the informativeness in the IQ treatment than in the Random treatment. When using the maximum likelihood strategy, the share increases from 40.9 to 65.5 percent in IQ and from 53.8 to 89.3 percent in Random, suggesting that many subjects aim to maximize the informativeness of signals but make mistakes.[15] The treatment difference of 23.8 percent is significant ($p<0.01$).

In both treatments, there are only few subjects who consistently choose feedback modes that are positively skewed. In particular, there are no subjects in IQ and 3.8 percent of subjects in Random. In the maximum likelihood estimations, the share in Random increases to 10.7 percent. However, note that it only requires three consistent choices to be attributed to this preference (in contrast to four for the other preferences), so a subject who makes random choices has the highest likelihood to be categorized as following Positive Skewness.

Finally, there are significantly more subjects in IQ than in Random who prefer to avoid negative framing. While more than 30 percent of subjects avoid negative framing in IQ, there are almost no subjects who reveal a preference for negative framing in Random. For negative framing we find the largest treatment difference with 34.5 percentage points ($p<0.01$).

[14] "Maximum Information" predicts that subjects make choices according to $A \succ B, C, D, E$, "Positive Skewness" predicts $B \succ A; E \succ A; A \succ C$, and "Avoid Negative Framing predicts $B \succ A; A \succ C, E; B \succ E$. Note that subjects can follow more than one preference but we assume that they have one dominant preference when these preferences conflict.

[15] In Appendix D we exploit the order in which feedback modes are presented and find evidence that the difference is to a large degree driven by subjects who do not understand that Mode E reveals less information than Mode A.

Table 2: Share of subjects revealing a consistent preference by treatment

Preferences	No Mistakes		Maximum Likelihood		
	IQ	Control	IQ	Control	Difference
Maximum Information	0.409	0.538	0.655***	0.893***	-0.238***
			(0.053)	(0.042)	(0.069)
Positive Skewness	0.000	0.038	0.000	0.107**	-0.107**
			(0.012)	(0.042)	(0.045)
Avoid Negative Framing	0.327	0.057	0.345***	0.000	0.345***
			(0.056)	(0.000)	(0.056)
Variance of error term (γ)			0.492***	0.585***	
			(0.046)	(0.050)	
Not classified	0.264	0.368			
N	110	106	110	106	

Notes: Table shows the share of subjects who choose feedback modes consistent with the respective preference. The preference Maximum Information prescribes $A \succ B, C, D, E$. Positive Skewness prescribes $B \succ A; A \succ C; E \succ A$. Avoid Negative Framing prescribes $B \succ A; A \succ C, E; B \succ E$. In "No Mistakes" we calculate the share choosing accordingly without allowing for implementation mistakes. In "Maximum Likelihood" we estimate the share allowing for implementation noise γ. Standard errors are bootstrapped with 300 replications. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To sum up, the within-individual choices support our findings from the individual information structure choices. When looking at internally consistent choice patterns, subjects in IQ compared to Random prefer less informative feedback modes and dislike negatively framed feedback. Moreover, we find few subjects who have a preference for positive skewness but, if anything, the share is higher in Random than in IQ.

3.1.2 Heterogeneity in Information Structure Selection

In the following, we investigate heterogeneity in information structure selection based on self-reported information preferences, gender, prior beliefs, and performance in the IQ quiz. We focus on the Baseline choice since this choice combines all three channels of ego protection: informativeness, skewness, and framing.

Information Preference Scale In the post-experimental questionnaire, subjects are asked to answer the Information Preference Scale (IPS) by Ho *et al.* (2018).[16] The scale consists of 13 scenarios from different domains (health, consumer finance, personal life), in which an individual can receive potentially unpleasant information (the items are shown in Appendix E). The respondent has to indicate her preference on a 4-point scale from "Definitely don't want to know" to "Definitely want to know".

[16] Ho *et al.* (2018) design and validate the Information Preference Scale in order to measure an individual's trait to obtain or avoid information. They show that it correlates strongly with related scales and that it even predicts information avoidance in the politics domain, a domain not represented in the scale itself.

Table 3: Heterogeneity in Baseline choice

	(1) IPS Scale	(2) Gender	(3) Prior Belief	(4) IQ Score
Quiz	0.323***	0.243**	0.196**	0.182**
	(0.083)	(0.107)	(0.073)	(0.091)
IPS (Info seeking)	0.064			
	(0.074)			
IPS (Info seeking) × Quiz	-0.259**			
	(0.117)			
Female		-0.121		
		(0.079)		
Quiz × Female		-0.064		
		(0.127)		
Low Prior			-0.060	
			(0.073)	
Quiz × Low Prior			-0.028	
			(0.125)	
Low IQ				0.018
				(0.074)
Quiz × Low IQ				0.020
				(0.120)
Constant	0.140***	0.244***	0.191***	0.159***
	(0.046)	(0.068)	(0.048)	(0.056)
R2	0.075	0.076	0.054	0.049
N	216	216	216	216

Notes: Table shows heterogenous treatment effects of the Quiz treatment on the choice of Mode B in the Baseline choice by IPS Scale, Gender, Prior belief, and IQ score. "IPS (Info seeking)" is an indicator for subjects who score in the top half of the Information Preference Scale (Ho *et al.*, 2018). "Low Prior" indicates if a subject reports a prior below 50 and "Low IQ" indicates if a subject has not scored more than the median in the IQ quiz. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Column (1) of Table 3, we regress the choice of Mode B in the Baseline Choice on the IQ treatment indicator, an indicator if a subject scores above the median in the IPS scale, and an interaction of the two variables. The significant interaction term implies that being information seeking according to the IPS scale is associated with a lower probability to choose less informative and positively framed feedback in the experiment. Moreover, the IPS scale is not associated with information structure choice in the Random treatment, as illustrated by the small and insignificant main effect of the IPS scale.

Gender In Column (2) of Table 3, we regress the choice of Mode B in the Baseline choice on the IQ treatment indicator interacted with a dummy variable that indicates if a subject is female. However, since the interaction term is small and far from significant, we conclude that there is no evidence for heterogeneous treatment effects by gender.

Prior Belief In Column (3) of Table 3, we investigate if the treatment effect of the ego-relevant treatment is different depending on the reported prior belief. "Low Prior" indicates that an individual reports a prior that is lower than 50%, while the reference group reports a prior above or equal to 50%. We do not observe that subjects with priors below 50% are differently affected by the treatment than individuals with priors above 50%.

IQ Score Finally, in the last column of Table 3, we analyze if there is a differential treatment effect for subjects who performed better or worse in the IQ quiz. "Low IQ" indicates that a subject has solved less or equally many Raven matrices correctly compared to the median (12). The insignificant and small interaction term suggests that there is no differential treatment effect depending on the performance in the IQ task (i.e., their measured cognitive ability).

3.1.3 Information Selection and Beliefs

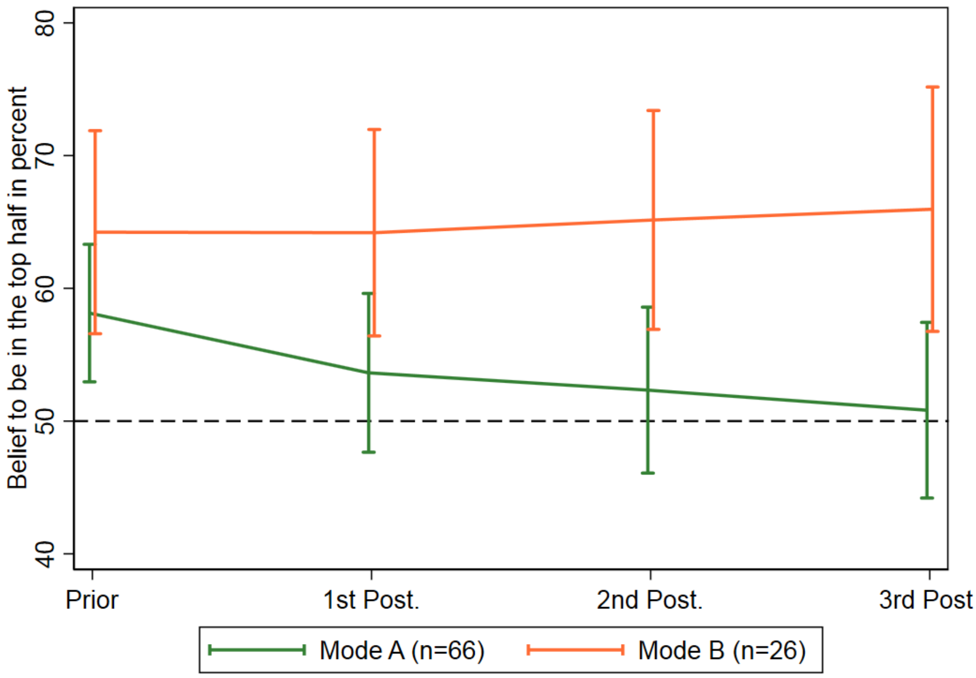
After subjects made the five information structure choices, one of these choices is randomly selected and the corresponding decision of the subject is implemented.

In Figure 4, we plot how the average beliefs in the IQ treatment evolve, depending on the feedback mode from which subjects receive signals. First, we observe that in the IQ treatment, subjects are *overconfident* in their prior beliefs: on average, they report a higher likelihood than 50% to be in the top half of the IQ distribution, both in Mode A ($t(65) = 3.138, p = 0.003$) and in Mode B ($t(25) = 3.834, p = 0.001$).[17] Second, there is no significant difference in priors between individuals who end up in Feedback Mode A and Mode B ($t(90) = 1.284, p = 0.202$). Third, while the average beliefs of subjects in Mode A seem to converge towards 50% after receiving signals from Feedback Mode A, the beliefs in Mode B remain constant. In fact, after three rounds of feedback we observe a significant difference in posterior beliefs between subjects in Feedback Mode A and B ($t(90) = 2.531, p = 0.013$).

These results suggest that selecting an information structure that is less informative and positively framed indeed leads to maintaining high beliefs in the IQ treatment. Moreover, in Appendix G, we show that such a pattern is not observed in the Control Treatment. In the following section, we investigate more closely how individuals update their beliefs depending on the feedback mode from which they receive signals.

[17] Benoît *et al.* (2015) show that true overconfidence is observed if the average stated probability to be in the top 50% of the distribution is significantly larger than 50%.

Figure 4: Beliefs before and after signals by Feedback Mode (Endogenous/IQ treatment)



Notes: Plot shows the average prior and posterior beliefs from treatment Endogenous/IQ for the selected Feedback Mode. The whiskers represent 95% confidence intervals.

3.2 Belief Updating

In the following, we aim to investigate how subjects process the signals they receive from different feedback modes. First, we introduce the estimation framework to analyze potential deviations from Bayesian updating. Afterwards, we analyze updating both in the Endogenous treatment and in the Exogenous treatment. While subjects in the Endogenous treatment receive signals from the self-selected feedback mode, subjects in the Exogenous treatment are allocated to one.

3.2.1 Estimation Framework

We follow the approach developed by Grether (1980) and Möbius *et al.* (2014) to estimate updating behavior. The framework allows individuals to put different weights on the prior and the positive or negative signals they may receive and nests the Bayesian benchmark as a special case. In the case of binary signals, Bayes rule can be written in the following form:

$$(1) \qquad logit(\mu_t) = logit(\mu_{t-1}) + \mathbb{1}(s_t = pos) ln(LR_{pos}) + \mathbb{1}(s_t = neg) ln(LR_{neg})$$

where μ_t is the belief at time t and LR_k is the likelihood ratio of the signal $s_t = k \in \{pos, neg\}$.

In order to estimate the model, we add an error term and attach coefficients to the prior and to the positive and negative signals an individual receives:

$$(2) \quad logit(\mu_{it}) = \delta^{\text{prior}} logit(\mu_{i,t-1}) \\ + \beta^{\text{pos}} \mathbb{1}(s_{it} = pos) ln(LR_{pos}) + \beta^{\text{neg}} \mathbb{1}(s_{it} = neg) ln(LR_{neg}) + \epsilon_{it}$$

where δ^{prior} captures the weight put on the prior while β^{pos} and β^{neg} measure the responsiveness to positive and negative signals, respectively. ϵ_{it} captures non-systematic errors in updating. A Bayesian updater would exhibit $\delta^{\text{prior}} = \beta^{\text{pos}} = \beta^{\text{neg}} = 1$. However, in this paper we do not focus on the comparison with the Bayesian benchmark, but we are mainly interested in differences in updating depending on the ego-relevance of the underlying state and across information structures. Thus, our analyses will focus on studying the β coefficients and their estimated differences across treatments and information structures.

More precisely, the estimated β coefficients in the control (i..e, where the state is not ego-relevant) will allow us to understand how updating behavior deviates from Bayes rule. Following the literature on belief updating, we interpret these deviations as being driven by "cognitive" biases. While the differential updating across the states, will allow us to

Table 4: Updating across feedback modes and treatments (Endogenous treatment)

	(1) IQ Mode A	(2) Random Mode A	(3) IQ Mode B	(4) Random Mode B
δ^{prior}	0.776***	0.680***	0.828***	0.832***
	(0.086)	(0.075)	(0.107)	(0.163)
β^{Pos}	0.596***	0.762***	0.541**	0.408**
	(0.140)	(0.156)	(0.198)	(0.178)
β^{Neg}	0.527***	0.750***	0.191**	0.205
	(0.111)	(0.129)	(0.084)	(0.272)
p-value (δ^{Prior}=1)	0.011	0.000	0.119	0.316
p-value (β^{Pos}=1)	0.005	0.132	0.028	0.004
p-value (β^{Neg}=1)	0.001	0.057	0.000	0.009
p-value (β^{Pos}=β^{Neg})	0.658	0.952	0.114	0.372
R2	0.692	0.700	0.816	0.664
N	155	144	78	57

Notes: Table shows regression results of Equation (2) in the Endogenous treatment, separately by IQ and Random treatment and Feedback Mode A and B. We regress the posterior belief on the prior belief and the signal's likelihood ratio, interacted with an indicator if the signal is positive or negative. The model does not include a constant. Standard errors clustered on subject level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

identify "motivated" or "psychological" biases in processing information. In particular, we will test whether there is asymmetric updating ($\beta^{pos} \neq \beta^{neg}$) in the ego-relevant treatment (e.g., subjects might have a desire to put more weight to positive than negative signals when forming their posteriors).

In doing so, we assume that cognitive biases in updating are held constant across the underlying valence of the state. Importantly, however, we do not assume that cognitive or motivated biases are constant across information structures. Indeed, the features of an information structure may have implications for both cognitive and motivated biases in updating.

3.2.2 Updating in the Endogenous Treatment

First, we focus on belief updating in the Endogenous treatment. Here, subjects receive signals from a feedback mode, which they selected in (at least) one of the five scenarios. We restrict the analysis to Feedback Modes A and B because for these feedback modes we have the highest number of subjects: In the IQ treatment, 66 (26) subjects update according to Mode A (B), and in the Random treatment 61 (19) subjects update according to Mode A (B).

Table 4 shows estimation results of Equation (2) separately by treatment and feedback mode. We present results for Mode A in columns (1) and (2) and for Mode B in columns (3) and (4). In all feedback modes and treatments we observe conservative updating ($\beta < 1$)

Table 5: Updating across feedback modes and treatments (Exogenous treatment)

	(1) Quiz Mode A	(2) Random Mode A	(3) Quiz Mode B	(4) Random Mode B
δ^{prior}	0.799***	0.726***	0.896***	0.779***
	(0.096)	(0.065)	(0.046)	(0.061)
β^{Pos}	0.631***	0.835***	0.482***	0.758***
	(0.122)	(0.124)	(0.077)	(0.174)
β^{Neg}	0.559***	0.761***	0.244***	0.938***
	(0.128)	(0.124)	(0.088)	(0.142)
p-value (δ^{Prior}=1)	0.042	0.000	0.026	0.001
p-value (β^{Pos}=1)	0.004	0.191	0.000	0.171
p-value (β^{Neg}=1)	0.001	0.059	0.000	0.662
p-value (β^{Pos}=β^{Neg})	0.659	0.676	0.028	0.325
R2	0.633	0.729	0.677	0.735
N	132	139	165	186

Notes: Table shows regression results of Equation (2) in the Exogenous treatment, separately by IQ and Random treatment and Feedback Mode A and B. We regress the posterior belief on the prior belief and the signal's likelihood ratio, interacted with an indicator if the signal is positive or negative. The model does not include a constant. Standard errors clustered on subject level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

which is consistent with previous evidence: subjects update less compared to the Bayesian benchmark (Möbius *et al.*, 2014; Coutts, 2019).

In Mode A, we do not find evidence for asymmetric updating in both treatments since the coefficients β^{Pos} and β^{Neg} are of similar magnitude and we cannot reject the null hypothesis that they are equal (p-value = 0.658). In Mode B, in contrast, we observe that β^{Pos} is larger than β^{Neg}, both in IQ and Random treatments. However, we do not have the statistical power to reject the null hypothesis that they are equal, since relatively few subjects end up in Mode B.

Hence, to have a sufficient number of subjects in Mode B and to exclude self-selection into feedback modes, in the next section we investigate updating in the Exogenous treatment.

3.2.3 Updating in the Exogenous Treatment

In the Exogenous treatment, subjects are randomly assigned into Feedback Mode A or B. In the IQ treatment, 55 (55) subjects update according to Mode A (B), and in the Random treatment 57 (62) subjects update according to Mode A (B).

In Table 5, we display the estimation results for the Exogenous treatment. As before, we do not find evidence for asymmetric updating in Mode A. Both in IQ and in Random, the

Table 6: Updating interacted with feedback modes by treatments

	Endogenous		Exogenous	
	(1)	(2)	(3)	(4)
	IQ	Random	IQ	Random
δ^{prior}	0.770***	0.671***	0.814***	0.716***
	(0.068)	(0.058)	(0.084)	(0.066)
β^{Pos}	0.594***	0.661***	0.623***	0.839***
	(0.108)	(0.126)	(0.119)	(0.127)
β^{Neg}	0.634***	0.751***	0.568***	0.767***
	(0.107)	(0.123)	(0.124)	(0.125)
δ^{prior} x Mode B	0.057	0.161	0.081	0.063
	(0.125)	(0.168)	(0.096)	(0.090)
β^{Pos} x Mode B	-0.053	-0.253	-0.142	-0.080
	(0.222)	(0.213)	(0.142)	(0.215)
β^{Neg} x Mode B	-0.443***	-0.546*	-0.324**	0.171
	(0.135)	(0.291)	(0.151)	(0.189)
R2	0.705	0.615	0.715	0.720
N	330	318	330	357

Notes: Table shows regression results of Equation (2), fully interacted with the feedback mode. The regressions are estimated separately by IQ and Random treatment as well as by Endogenous and Exogenous treatment. We regress the posterior belief on the prior belief and the signal's likelihood ratio, interacted with an indicator if the signal is positive or negative. All of these variables are fully interacted with the feedback mode. The model does not include a constant. Standard errors clustered on subject level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

coefficients β^{Pos} and β^{Neg} are of similar magnitude and not significantly different from each other (p-value = 0.659 in IQ and p-value = 0.676 in Random).

However, we find asymmetric updating in Mode B in the IQ treatment: when information is ego-relevant and negative signals are neutrally framed, subjects update less to negative than to positive signals. The updating coefficient for positive signals is about twice as large as for negative signals and the coefficients differ significantly (p-value=0.028). However, this is not the case when feedback is not ego-relevant: in the Random treatment, subjects update, if anything, more to negative feedback that is neutrally framed but the difference in coefficients is not significant (p-value=0.735).

In Table 6, we interact the feedback mode with the signal received, separately by treatment. In both Endogenous and Exogenous treatments, subjects update significantly less to negative feedback in Mode B when signals are ego-relevant (Columns 1 and 3). However, when information is not ego-relevant, the interaction is only marginally significant in the Endogenous treatment (Column 2). The interaction is not significant and even slightly positive in the Exogenous treatment (Column 4), suggesting that the negative coefficient in the Endogenous treatment is due to selection. Namely, a number of subjects who end up in Mode B in the Endogenous/Random treatment, choose Mode B in the Baseline choice – in Random this decision can neither be explained by payout maximization nor by motivated beliefs. Hence, this is a selected group of subjects and their updating behavior should be interpreted with caution.

Taken together, these results suggest that subjects' belief formation is driven by motivated reasoning as subjects asymmetrically update only in the IQ treatment. However, while individuals might have a preference to form high beliefs of themselves, our results show that this does not seem to be always possible. In fact, our results show that asymmetric updating arises only in the information structure that features negative signals that are framed in a way that makes it easier to misperceive them. In the next section, we further discuss and interpret our experimental results.

4 Discussion

Our experimental findings show a striking difference across treatments in the way subjects choose between different feedback modes. We have interpreted these results as evidence for differential preferences over information structures driven by motivated reasoning – biases that are driven by specific individuals' goals (e.g., of having high opinions of oneself and self-enhancement motives). We now discuss whether treatment differences could alternatively be explained by cognitive biases. In doing so, we follow the key features that distinguish motivated thinking from cognitive failures according to Bénabou and Tirole (2016).

4.1 Endogenous Directionality

A distinct feature of motivated reasoning is that it is directed towards some end (e.g., the belief to have high intelligence). In contrast, general failures in cognitive reasoning that depend on one's prior beliefs, like confirmation-seeking and contradiction-seeking behavior, usually go in either direction. In the following we discuss if these tendencies can explain our results.

4.1.1 Confirmation-Seeking Behavior

Confirmation-seeking behavior, also known as confirmation bias, is the tendency to search for, interpret, favor, and recall information in a way that confirms one's preexisting beliefs. In our experiment, this bias could explain treatment differences in information structure selection if participants with different priors have different beliefs over the informational content of our feedback modes and/or have a preference for receiving signals that confirm their priors. This could (partly) explain treatment differences as subjects in the treatment group have (slightly) higher prior beliefs than those in the control (60.1% vs. 54.2%).[18] For instance, it could be the case that participants with high priors believe that, in our Baseline choice, mode B is more informative than mode A. However, even when controlling for prior beliefs, we see that subjects in the ego-relevant treatment are more likely to choose feedback mode B as compared to those in the control. Similarly, as shown in Table A.2 in the Appendix, our treatment differences in all feedback mode choices hold when controlling for prior beliefs. Finally, it is of relevance to note that, in the informativeness choice, there is no role for confirmation-seeking behavior. Thus, this difference cannot be explained through confirmation bias. Taken together, these results show that confirmation bias falls short in explaining the treatment differences in the information selection stage of our experiment.

4.1.2 Contradiction-Seeking Behavior

Contrary to confirmation bias, contradiction-seeking behavior can be defined as the tendency to search for, interpret, favor, and recall information that goes against one's prior beliefs. As above, this bias could explain treatment differences in information structure selection if participants with different priors have different beliefs over the informational content of the feedback modes and/or have a preference for receiving signals that disconfirm their priors. However, by the same arguments as for confirmation-seeking behavior, we can rule out contradiction-seeking behavior as an alternative explanation for our treatment differences.

4.2 Bounded Rationality

4.2.1 Cognitive ability

Cognitive errors in processing and interpreting information do vary by individuals' cognitive ability and analytical sophistication. That is, more able and more analytically sophisticated agents are less prone to such cognitive biases. On the other hand, motivated reasoning does not necessarily imply such negative correlation.

By taking into account participants' abstract reasoning ability as measured by their scores in the IQ test, our results do not seem to be driven by cognitive ability. Two pieces of evidence support this conclusion. First, individuals across treatment groups do not vary in their cognitive ability.[19] Second, our treatment differences in feedback mode selection are robust to controlling for individuals' cognitive ability (see Column (4) in Table A.2 in the Appendix).

[18] However, the difference is not statistically significant at conventional levels (p-value=0.101).

[19] Mean IQ scores in the IQ treatment is 11.34, while 11.41 in the control. A Mann-Whitney test fails to reject the null that the difference in distributions is significantly different from 0 (p-value=0.78).

4.2.2 Confusion

Our experimental design features some elements that increased the complexity of our experiment and thus might have affected participants' understanding. To tackle this possibility, we paid particular attention to the way we presented the experimental instructions to our participants. We also ensured participants' understanding by letting them answer comprehension questions. However, and more importantly, any participants' confusion is unlikely to be a driving force of our results as it is held constant across our treatment conditions.

Furthermore, if we look at the informativeness choice in which the information structures only differ in the likelihood to receive an uninformative signal, and where we held constant their skewness and framing, we see that less than 5 percent of subjects in the control choose the suboptimal choice. This finding is reassuring as it implies that subjects understood fairly well our experimental instructions and were sufficiently incentivized to choose the optimal decision.

4.3 Emotional Involvement: Heat vs. Light

Finally, Bénabou and Tirole (2016) argue that motivated beliefs evoke and trigger emotional reactions, whereas cognitively driven biases do not. While we do not measure participants' emotions in the experiment there is suggestive evidence in favor of emotions arising in the treatment group. This is further evidence in favor of motivated reasoning driving our results as opposed to cognitive failures. First, in the open-text question where we asked subjects to describe how they chose between different information structures, participants in the IQ treatment were more likely to report answers that stated their willigness to avoid negative (red) signals, whereas in the control this is not the case. This differential response by treatment suggest that participants in the IQ treatment did choose specific feedback modes to avoid feeling negative emotions. Second, the informativeness choice result clearly shows that individuals in the IQ treatment are more inclined to protect their beliefs (and, presumably their emotions) since a Bayesian, or even boundedly rational thinker, without motivated beliefs would welcome more information.

In summary, in this section we have argued that our results cannot be accounted for by cognitive biases and, in particular, by endogenous directionality and bounded rationality, including cognitive ability and confusion. On the other hand, there is suggestive evidence that participants' behavior could be driven by emotional reactions due to the ego-relevance of the underlying state.

5 Conclusion

We run an experiment to study individuals' preferences over information structures and subsequent belief updating if information is ego-relevant or neutral. Our results from the information selection stage show that individuals in the ego-relevant treatment are more likely to choose less informative and positively framed information structures as compared to those in the control. These findings suggest that individuals selectively choose information structures that allow them to protect their ego. Moreover, the results from the belief updating stage indicate that individuals' belief formation is asymmetric (i.e., individuals respond more to positive news than to negative ones) but only in the ego-relevant condition and when the information structure is framed in a way that makes it easier to misperceive the negative signal. These results are also informative to the literature on asymmetric updating, and their mixed findings. Indeed, the different ways in which the signals are framed across studies could partly explain the differential results in the literature.

Our results suggest that while individuals might have a motivated tendency to process information differently depending on its valence, their ability to do so depends on the "reality" constraints in the environment. We show that the framing of feedback is one dimension of "reality" constraints that allows individuals to maintain and nurture motivated beliefs. Zimmermann (2019) shows that raising the incentives to recall negative feedback can constitute another "reality constraint". This raises the question for future research to assess other dimensions in the environment that may constrain individuals in holding motivated beliefs and how consciously people engage in motivated thinking.

Taken together, our findings suggest that motivated information acquisition might play a key role in producing overconfident beliefs. Indeed, it is often the case that, in our everyday life, we can choose our information sources and, therefore, have some control over the type of signals that we receive. In other words, this choice can enable us to protect ourselves from receiving "bad" news about our abilities. Thus, future research should pay more attention to the different ways in which individuals can and do self-select into environments to receive (avoid) more flattering (damaging) feedback to the self. Moreover, as found in our experimental data, information source selection also interacts with the subsequent belief formation process as some signals allow the self to interpret the underlying information in a self-serving manner. These results have important implications. Namely, feedback procedures at the workplace, that aim at disclosing unbiased information, should not allow employees discretion over the information sources, as to avoid biased information transmission. This could be, for instance, implemented by having a third-party assessing workers' performance. Similarly, the anticipation of different feedback cultures (e.g., at the workplace, at the industry-level, or profession) may be an important driver that prevents people from undertaking certain career paths.

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A Additional Tables

Table A.1: Descriptive statistics

	Endogenous		Exogenous	
	IQ	Random	IQ	Random
Age (Mean)	20.973	21.830	20.236	20.168
	(2.960)	(4.095)	(2.933)	(2.304)
Female (Share)	0.664	0.613	0.618	0.529
	(0.475)	(0.489)	(0.488)	(0.501)
Native English speakers (Share)	0.427	0.377	0.364	0.370
	(0.497)	(0.487)	(0.483)	(0.485)
Studying (Share)	0.964	0.972	0.955	0.975
	(0.188)	(0.167)	(0.209)	(0.157)
First year students (Share)	0.455	0.481	0.545	0.504
	(0.500)	(0.502)	(0.500)	(0.502)
IQ puzzles solved (Mean)	11.336	11.406	10.964	10.924
	(3.425)	(3.397)	(3.038)	(3.051)
N	110	106	110	119

Notes: Table shows descriptive statistics of the experimental dataset. Standard deviations are in parentheses.

Table A.2: Information structure choices controlling for covariates

	(1)	(2)	(3)	(4)	(5)	(6)
Baseline	0.194***	0.192***	0.178***	0.193***	0.189***	0.161***
	(0.059)	(0.060)	(0.059)	(0.059)	(0.058)	(0.061)
Informativeness	0.135***	0.136***	0.132***	0.134***	0.132***	0.132***
	(0.042)	(0.044)	(0.043)	(0.042)	(0.042)	(0.042)
Framing	-0.264***	-0.266***	-0.243***	-0.265***	-0.263***	-0.263***
	(0.064)	(0.067)	(0.065)	(0.065)	(0.065)	(0.065)
Skewness over Framing	-0.166***	-0.129**	-0.164***	-0.165***	-0.167***	-0.122**
	(0.057)	(0.059)	(0.057)	(0.057)	(0.057)	(0.058)
Baseline reversed	-0.052	-0.036	-0.049	-0.053	-0.052	-0.037
	(0.050)	(0.052)	(0.050)	(0.050)	(0.051)	(0.058)
Demographics		✓				✓
Prior			✓			✓
IQ Score				✓		✓
Risk					✓	✓
N	216	216	216	216	216	216

Table shows the coefficient of the IQ treatment dummy in the regression of the feedback mode choice on the respective covariates. Demographics comprises controls for gender, age, years of study, and whether English is the native language. The risk measure is by Gneezy and Potters (1997). Robust standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Belief Elicitation Mechanism

Once Part I was completed and before we explained Part II, we told subjects that for the following part of the experiment we would ask them their beliefs regarding some events. In particular, they were told that they would be asked four belief questions and that one question would be chosen at random to count for payments.

We thus explained to them our belief elicitation procedure. We used the belief elicitation mechanism proposed by Karni (2009) called the matching probabilities method.[20] Under this method, subjects are presented with two possible bets: the lottery and the event. Each bet either pays a prize p (£6.00 in our experiment) or nothing. More specifically:

- The Event: pays the prize p if the event occurs, 0 otherwise.
- The Lottery: pays the prize p with probability x for $x \in \{0, 1, 2, ..., 100\}$, and 0 otherwise;

Hence, subjects (through their answers to the belief question) indicate which probability x makes them indifferent between betting on the event or the lottery. After they indicate the indifference point, one probability $y \in \{0, 1, 2, ..., 100\}$ is drawn. If $x \geq y$, the subject bets on the event and earns the prize p if the event occurs. On the other hand, if $x < y$ the subject bets on the lottery, which has probability y of paying the prize p. Intuitively, by choosing x, the subject affects her chances of betting on the event or the lottery and the chances of earning the prize p in case she ends up betting on the lottery. Under this mechanism, reporting one's subjective probability of the event occurring maximizes the chances of earning the prize, regardless of risk preferences.

Given the complexity of this belief elicitation mechanism, we decided to make instructions intuitive for subjects by walking them through an example and explaining them how their answer would affect the chances of them betting on the event or the lottery and their chances of winning the prize. We also emphasized that truthful reporting was the answer that maximized the chances of earning the prize. To ensure that subjects have understood the main features of this elicitation procedure, we asked subjects to answer comprehension questions about the belief elicitation procedure.

[20]This method has also been referred to as the "crossover mechanism", "reservation probabilities", and "lottery method". This belief elicitation mechanism was first introduced in an experiment by Möbius *et al.* (2014) and since then has been extensively applied to other experiments in the asymmetric updating literature such as Coutts (2019), Buser *et al.* (2018) and Schwardmann and Van der Weele (2019).

C Maximum Likelihood Estimation of Within-Subject Choice Patterns

We adapt the estimation strategy proposed by Dal Bó and Fréchette (2011) for choice strategies. The likelihood that the data corresponds to a given preference is given by $y_{ic} = I\left\{s_{ic}(s^P) + \gamma\epsilon_{ic} \geq 0\right\}$ where y_{ic} is the choice by subject i in choice situation c (0 for the first choice and 1 for the second choice). s_{ic} is the choice that is prescribed by the preference s^P (coded by -1 for the first choice and 1 for the second choice). $I\{.\}$ is 1 if the subject follows the prescribed strategy and 0 otherwise. ϵ_{ic} is an iid error term that is type 1 extreme value distributed and γ is the variance of the error term. Hence, the likelihood of subject i that follows preference s^P is

(3) $$p_i(s^P) = \prod_C \left(\frac{1}{1 + exp(-s_{ic}(s^P))/\gamma}\right)^{y_{ic}} \left(\frac{1}{1 + exp(s_{ic}(s^P))/\gamma}\right)^{1-y_{ic}}.$$

The resulting log likelihood is $\sum_I \ln(\sum_P p(s^P)p_i(s^P))$, which is summed over all I subjects by treatment and where P represents the three preferences we consider. $p(s^P)$ is the estimated fraction of the sample with preference P.

D Investigation of Order Effects

The subjects in our experiment make five consecutive choices between information structures. Since only one of these five choices is randomly selected to become relevant, each individual choice can be treated as an independent choice. However, one may be concerned about potential order effects if subjects' subsequent choices are affected by their previous choices, e.g., due to a preference for consistency. Moreover, in the experimental instructions, we always use the first feedback mode choice as an example to explain the choice situation (see Figures G.3 to G.5). Hence, it is possible that subjects have a better understanding of the feedback mode choice that is presented first. However, note that potential order effects are not affecting our results if they are constant between IQ and Random treatments. To check if there are differential order effects between treatments, we vary the order in which subjects make pairwise choices. The different orders with the respective number of subjects are presented in Table D.1.

Table D.1: Order of feedback mode choices

Feedback choice	Order 1	Order 2	Order 3
Baseline (A vs B)	1^{st}	2^{nd}	3^{rd}
Informativeness (A vs D)	3^{rd}	3^{rd}	4^{th}
Framing (B vs E)	5^{th}	4^{th}	2^{nd}
Skewness over Framing (A vs E)	4^{th}	5^{th}	1^{st}
Baseline Reversed (A vs C)	2^{nd}	1^{st}	5^{th}
N	116	51	49

Notes: Table shows the order with which the respective Feedback Mode Choice is presented.

In Table D.2 we interact the treatment dummy with a dummy indicating if a subject makes feedback mode choices according to the first, second, or third order. Most importantly, as indicated by the insignificant interaction effects, we do not find much support for differential order effects between treatments. This suggests that order effects are of no concern for our conclusions.

Interestingly, in Column (4), we observe that in both treatments significantly less subjects select Mode E in the Skewness over Framing Choice when this choice represents the first scenario (i.e., in the third order) This could be explained by the fact that in Order 3 this choice is presented first and is used as an example in the instructions (cf. Figure G.5). Hence, in Order 3 subjects may understand better that Mode E is, in fact, less informative than Mode A. This is supported by the observation that the fraction of subjects who follow a strict preference to maximize the informativeness in Table 2, increases substantially from 0.409 to 0.500 in the IQ treatment and from 0.538 to 0.689 in the Control treatment when abstracting from the Skewness over Framing Choice.

Table D.2: Feedback mode choice by presented order

	(1) Baseline	(2) Informativeness	(3) Framing	(4) Skewness over Framing	(5) Baseline reversed
Quiz	0.199***	0.151***	-0.324***	-0.200**	-0.057
	(0.076)	(0.057)	(0.087)	(0.083)	(0.070)
Order 2	0.077	0.005	-0.081	-0.066	-0.073
	(0.092)	(0.047)	(0.121)	(0.115)	(0.085)
Order 3	0.127	0.048	-0.061	-0.219**	0.057
	(0.100)	(0.062)	(0.123)	(0.101)	(0.104)
Quiz x Order 2	0.024	0.001	0.075	-0.005	0.014
	(0.148)	(0.105)	(0.158)	(0.141)	(0.110)
Quiz x Order 3	-0.049	-0.075	0.184	0.153	0.007
	(0.154)	(0.110)	(0.167)	(0.131)	(0.140)
Constant	0.123***	0.035	0.561***	0.386***	0.193***
	(0.044)	(0.025)	(0.067)	(0.065)	(0.053)
R2	0.060	0.047	0.084	0.062	0.019
N	216	216	216	216	216

Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

E Information Preference Scale (Ho *et al.*, 2018)

- As part of a semi-annual medical checkup, your doctor asks you a series of questions. The answers to these questions can be used to estimate your life expectancy (the age you are predicted to live to). Do you want to know how long you can expect to live? [1: Definitely don't want to know; 4: Definitely want to know]

- You provide some genetic material to a testing service to learn more about your ancestors. You are then told that the same test can, at no additional cost, tell you whether you have an elevated risk of developing Alzheimer's. Do you want to know whether you have a high risk of developing Alzheimer's? [1: Definitely don't want to know; 4: Definitely want to know]

- At your annual checkup, you are given the option to see the results of a diagnostic test which can identify, among other things, the extent to which your body has suffered long-term effects from stress. Do you want to know how much lasting damage your body has suffered from stress? [1: Definitely don't want to know; 4: Definitely want to know]

- Ten years ago, you had the opportunity to invest in two retirement funds: Fund A and Fund B. For the past 10 years, you have invested all your retirement savings in Fund A. Do you want to know the balance you would have, if you had invested in Fund B instead? [1: Definitely don't want to know; 4: Definitely want to know]

- You decide to go to the theater for your birthday and give your close friend (or partner) your credit card so they can purchase tickets for the two of you, which they do. You aren't sure, but suspect that the tickets may have been expensive. Do you want to know how much the tickets cost? [1: Definitely don't want to know; 4: Definitely want to know]

- You bought an electronic appliance at a store at what seemed like a reasonable, though not particularly low, price. A month has passed, and the item is no longer returnable. You see the same appliance displayed in another store with a sign announcing 'SALE.' Do you want to know the price you could have bought it for? [1: Definitely don't want to know; 4: Definitely want to know]

- You gave a close friend one of your favorite books for her birthday. Visiting her apartment a couple of months later, you notice the book on her shelf. She never said anything about it; do you want to know if she liked the book? [1: Definitely don't want to know; 4: Definitely want to know]

- Someone has described you as quirky, which could be interpreted in a positive or negative sense. Do you want to know which interpretation he intended? [1: Definitely don't want to know; 4: Definitely want to know]

- You gave a toast at your best friend's wedding. Your best friend says you did a good job, but you aren't sure if he or she meant it. Later, you overhear people discussing the toasts. Do you want to know what people really thought of your toast? [1: Definitely don't want to know; 4: Definitely want to know]

- As part of a fund-raising event, you agree to post a picture of yourself and have people guess your age (the closer they get, the more they win). At the end of the event, you have the option to see people's guesses. Do you want to learn how old people guessed that you are? [1: Definitely don't want to know; 4: Definitely want to know]

- You have just participated in a psychological study in which all the participants rate one-anothers' attractiveness. The experimenter gives you an option to see the results for how people rated you. Do you want to know how attractive other people think you are? [1: Definitely don't want to know; 4: Definitely want to know]

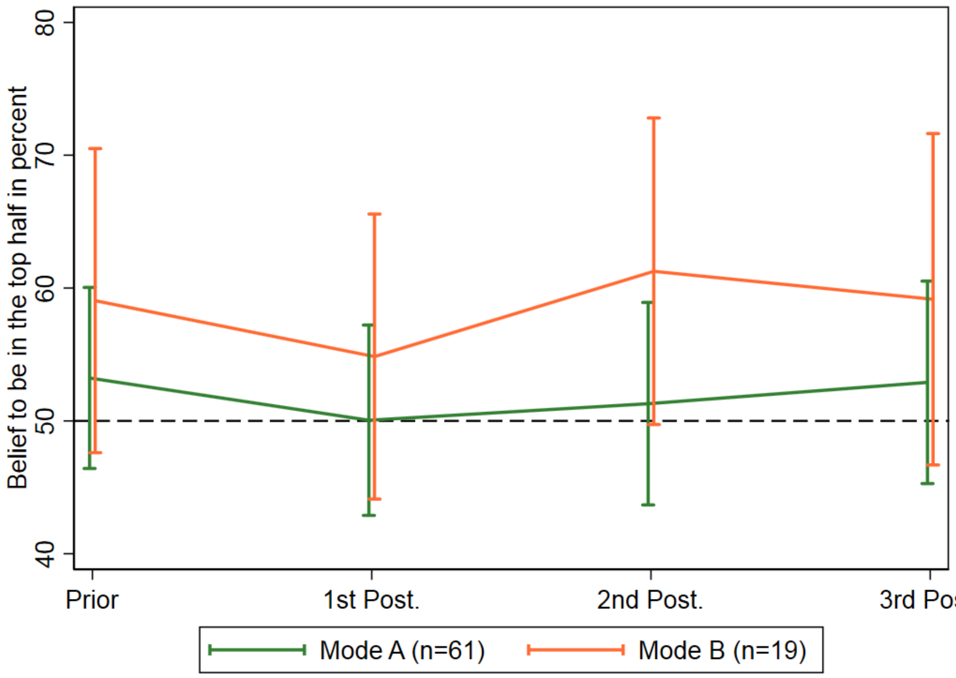
- Some people seek out information even when it might be painful. Others avoid getting information that they suspect might be painful, even if it could be useful. How would you describe yourself? [1: If it could be painful, I don't want to know; 4: Even if it could be painful, I always want to know]

- If people know bad things about my life that I don't know, I would prefer not to be told. [1: Strongly agree; 4: Strongly disagree]

F Information Selection and Beliefs in the Control Treatment

In Figure F.1, we plot the prior and posterior beliefs after three rounds of feedback in the Endogenous/Control Treatment. First, as in the IQ Treatment, we observe that prior beliefs between Mode A and B are not significantly different from each other ($t(78) = 0.853, p = 0.396$). However, unlike in the IQ Treatment we do not observe that beliefs in the Feedback Mode diverge with the arrival of signals and, in fact, also the posterior beliefs after three signals are not significantly different ($t(78) = 0.824, p = 0.413$).

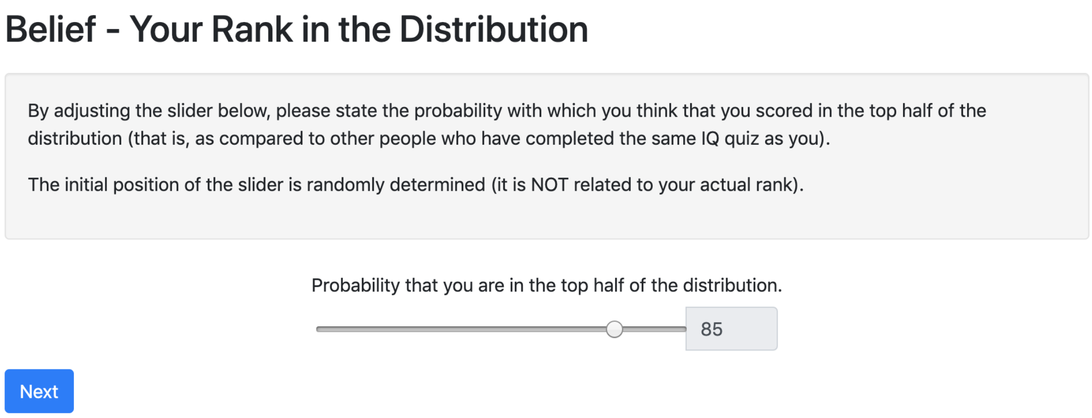
Figure F.1: Beliefs before and after signals by Feedback Mode (Endogenous/Control treatment)



Notes: Plot shows the average prior and posterior beliefs (after each of the three signals) from treatment Endogenous/Control for the selected Feedback Mode. The whiskers represent 95% confidence intervals.

G Screenshots of the Experiment

Figure G.1: Screenshot of the prior belief elicitation template in the IQ treatment



Notes: The figure displays a screenshot of the template in which we asked the participant, in the IQ treatment, to state his/her prior belief about his/her relative rank.

Figure G.2: Screenshot of the instructions' template about the possible signals the participant can receive in the IQ/Endogenous treatment

Instructions Task 2 - Feedback about your IQ Rank

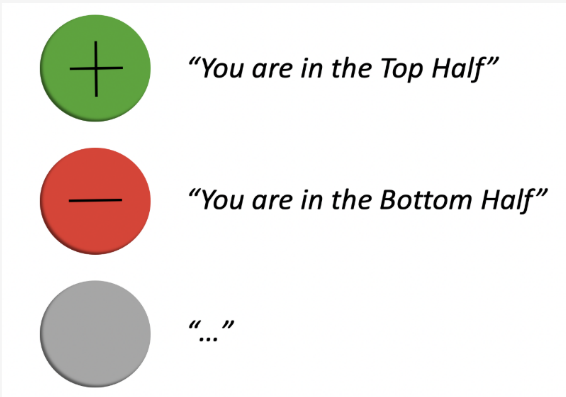
Now, you will receive additional information (feedback) about your performance in the IQ quiz to help you assess whether or not you are in the top half of the distribution.

What is Feedback?
Depending on your rank in the distribution, you will receive feedback about your rank. You can receive three types of feedback in the form of evaluations:

- The green evaluation that tells you: "You are in the Top Half";
- The red evaluation that tells you: "You are in the Bottom Half";
- The grey evaluation that tells you: "...".

Figure 1 shows you the exact three possible evaluations that you can receive.

Figure 1: Feedback

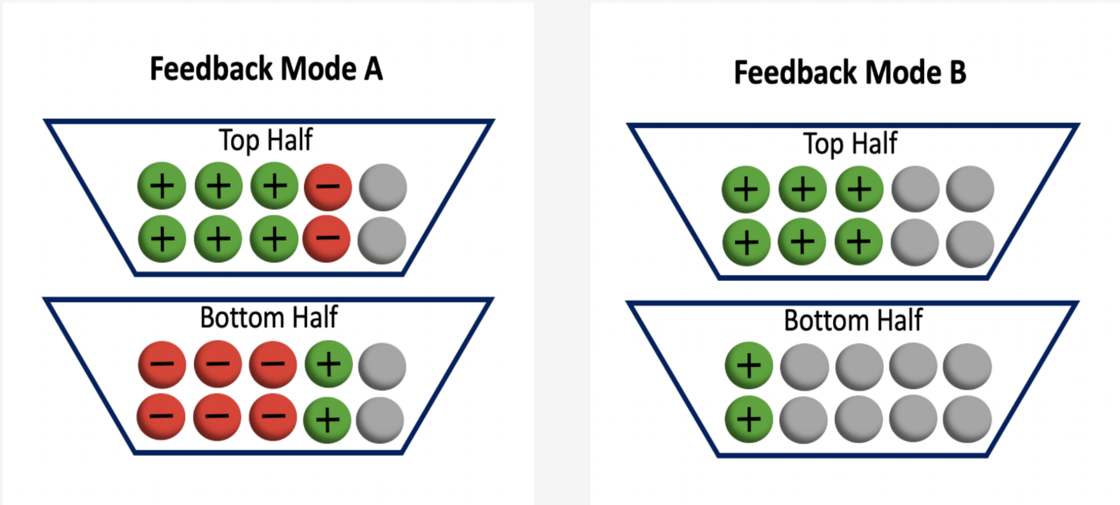


Notes: The figure displays a screenshot of the template in which we explain the participant, in the IQ/Endogenous treatment, the possible signals he/she can receive about his/her performance.

Figure G.3: Screenshot of the instructions' template about the feedback mode selection (Order 1) in the IQ/Endogenous treatment

How is the feedback determined?
Which evaluation (feedback) you receive depends on your actual rank in the distribution in the IQ quiz and the "feedback mode" from which the feedback is generated. However, the feedback does not completely reveal your rank in the distribution.

Let's consider an example of two feedback modes to make things clearer:



Notice that:

- Irrespective of the feedback mode you choose, if you are in the top half of the distribution your feedback will be determined by the urn at the top of each figure. If you are in the bottom half, your feedback will be determined by the urn at the bottom.
- Consider the example above. In both feedback modes you are more likely to get the green evaluation if you are in the top half of the distribution. However, if you choose to receive feedback from Feedback Mode A, you are more likely to get the red evaluation if you are in the bottom half of the distribution. In Feedback Mode B, in contrast to Feedback Mode A, you will never get the red evaluation but instead the grey evaluation. Thus, Feedback Mode A is more informative than Mode B in case that you are in the bottom half.

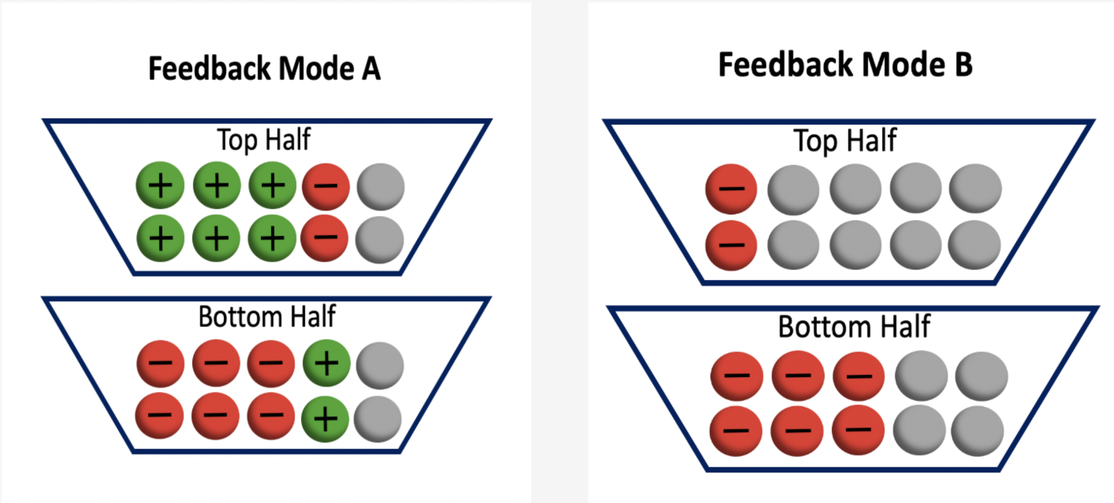
Notes: The figure displays a screenshot of the template in which we explain the participant, in the IQ/Endogenous treatment, the selection of feedback modes and how feedback modes differ. In Order 1, we use the Baseline Choice as an example.

Figure G.4: Screenshot of the instructions' template about the feedback mode selection (Order 2) in the IQ/Endogenous treatment

How is the feedback determined?

Which evaluation (feedback) you receive depends on your actual rank in the distribution in the IQ quiz and the "feedback mode" from which the feedback is generated. However, the feedback does not completely reveal your rank in the distribution.

Let's consider an example of two feedback modes to make things clearer:



Notice that:

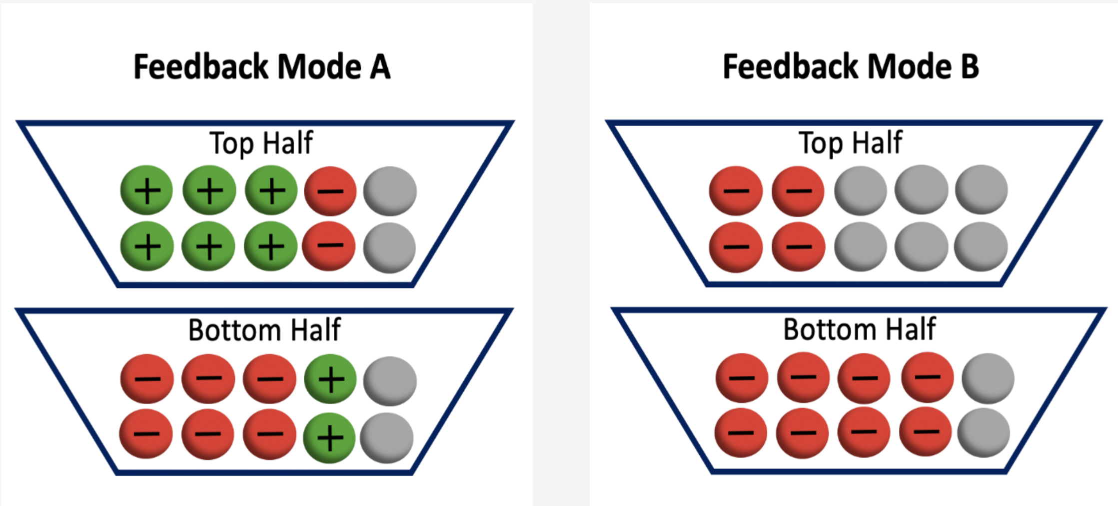
- Irrespective of the feedback mode you choose, if you are in the top half of the distribution your feedback will be determined by the urn at the top of each figure. If you are in the bottom half, your feedback will be determined by the urn at the bottom.
- Consider the example above. In both feedback modes you are more likely to get the red evaluation if you are in the bottom half of the distribution. However, if you choose to receive feedback from Feedback Mode A, you are more likely to get the green evaluation if you are in the top half of the distribution. In Feedback Mode B, in contrast to Feedback Mode A, you will never get the green evaluation but instead the grey evaluation. Thus, Feedback Mode A is more informative than Mode B in case that you are in the top half.

Notes: The figure displays a screenshot of the template in which we explain the participant, in the IQ/Endogenous treatment, the selection of feedback modes and how feedback modes differ. In Order 2, we use the Baseline Reversed Choice as an example. Hence, Mode B in this screenshot is called Mode C in the rest of the paper.

Figure G.5: Screenshot of the instructions' template about the feedback mode selection (Order 3) in the IQ/Endogenous treatment

How is the feedback determined?
Which evaluation (feedback) you receive depends on your actual rank in the distribution in the IQ quiz and the "feedback mode" from which the feedback is generated. However, the feedback does not completely reveal your rank in the distribution.

Let's consider an example of two feedback modes to make things clearer:



Notice that:

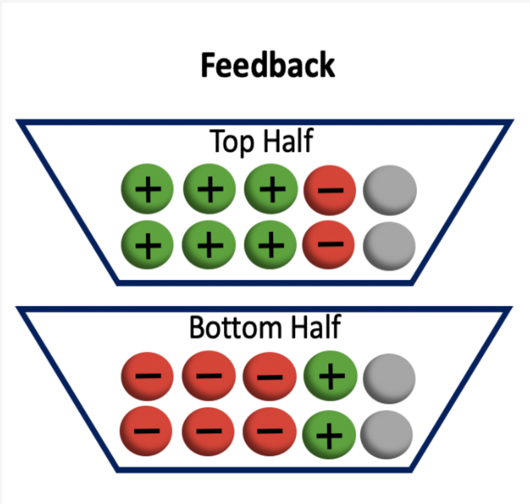
- Irrespective of the feedback mode you choose, if you are in the top half of the distribution your feedback will be determined by the urn at the top of each figure. If you are in the bottom half, your feedback will be determined by the urn at the bottom.
- Consider the example above. In both feedback modes you are more likely to get the red evaluation if you are in the bottom half of the distribution. However, if you choose to receive feedback from Feedback Mode A, you are more likely to get the green evaluation if you are in the top half of the distribution. In Feedback Mode B, in contrast to Feedback Mode A, you will never get the green evaluation. Note that Feedback Mode A is more informative than Mode B in case that you are in the bottom half.

Notes: The figure displays a screenshot of the template in which we explain the participant, in the IQ/Endogenous treatment, the selection of feedback modes and how feedback modes differ. In Order 3, we use the Skewness over Framing Choice as an example. Hence, Mode B in this screenshot is called Mode E in the rest of the paper.

Figure G.6: Screenshot of the instructions' template about the feedback mode (Exogenous treatment)

How is the feedback determined?

Which evaluation you receive depends on your actual rank in the distribution in the IQ quiz. If you are in the top half of the distribution, your feedback will be determined by the urn at the top of the figure. If you are in the bottom half, your feedback will be determined by the urn at the bottom. However, the feedback does not completely reveal your rank in the distribution.

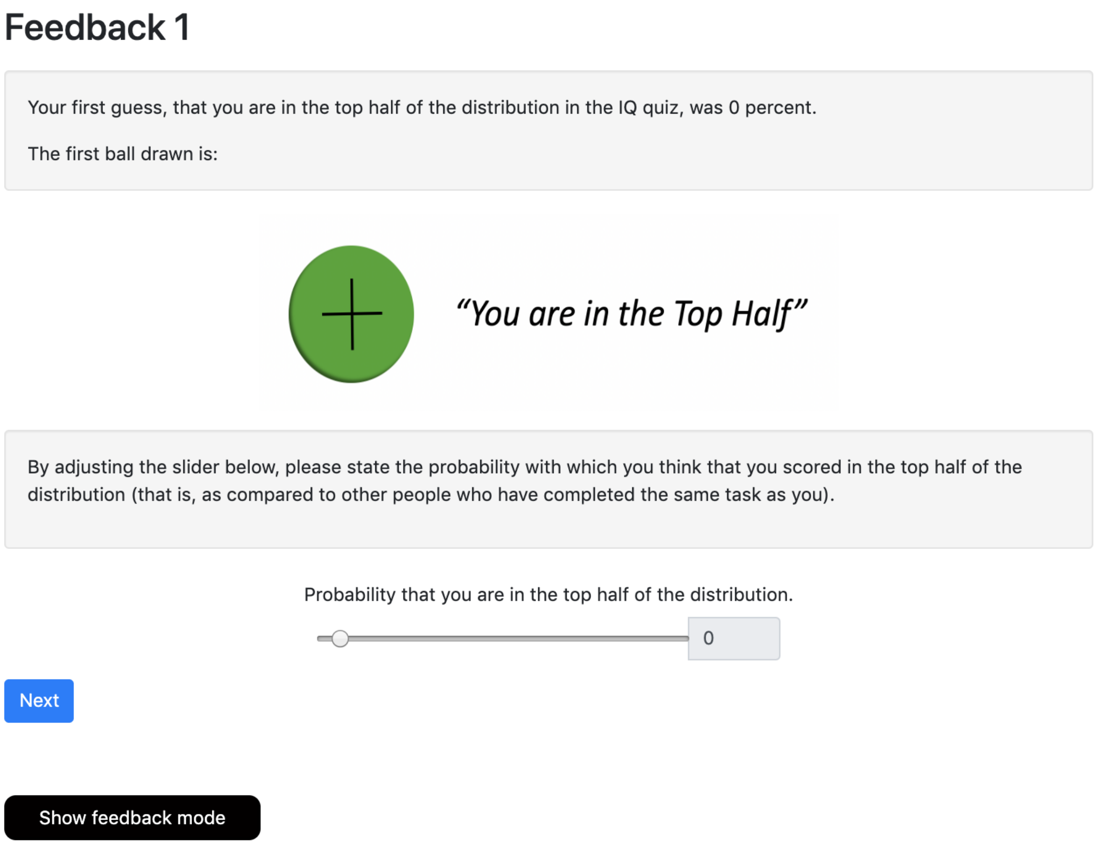


Notice that:

- You are more likely to get the green evaluation if you are in the top half of the distribution.
- You are more likely to get the red evaluation if you are in the bottom half of the distribution.

Notes: The figure displays a screenshot of the template in which we explain the participant, in the IQ/Exogenous treatment, how signals are drawn. In this example, the participant was exogenously assigned to Feedback Mode A.

Figure G.7: Screenshot of the posterior belief elicitation template in the IQ treatment following a "green" signal



Notes: The figure displays a screenshot of the template in which we asked the participant, in the IQ treatment, to state his/her posterior belief about his/her relative rank following a "green" signal.