Motivated Information Acquisition
in Social Decisions*

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Abstract

Individuals can often inquire about how their decisions would affect others. When do they stop the inquiry if they prefer one of their options for selfish reasons? We present causal evidence that having a selfishly preferred option makes individuals more likely to *continue* the inquiry when the dominant information received up to that point suggests that behaving selfishly harms others. In contrast, when the dominant information up to that point suggests that being selfish harms nobody, individuals become more likely to *stop* acquiring information. Drawing on the Bayesian persuasion model of Kamenica and Gentzkow (2011), we propose a theoretical model showing that this information acquisition strategy can be optimal for a Bayesian agent who values the belief of herself doing no harm on others but attempts to persuade herself to behave self-interestedly. The model predicts that strategic information acquisition motivated by self-interest can *reduce* the decisions' resulting negative externalities and *improve* the welfare of the affected others. This is indeed found to be the case in our laboratory experiment.

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1   Introduction

The motivated reasoning literature demonstrates that people often trade off the accuracy against the desirability of their beliefs (for a review, see Bénabou and Tirole, 2016). The desirability of beliefs can arise in decisions where benefiting oneself *might* harms others. In these situations, individuals can behave selfishly without a guilty conscience if they believe that the selfish decision harms no others (for a review, see Gino, Norton, and Weber, 2016). This paper analyzes how individuals acquire information in such social decisions.

We focus on information that unveils the unknown externalities gradually (i.e. *noisy* information). Whereas a piece of one-shot perfect information uncovers the truth immediately, noisy information increases one's belief accuracy bit by bit. Individuals can not only decide whether to start acquiring noisy information, but also *when* to stop the inquiry. Compared to perfect information, noisy information offers individuals a higher chance to end up with beliefs more desirable than their initial beliefs, by allowing them to choose strategically when to stop their inquiry.

In many economic decisions with potential externalities, individuals can acquire noisy information to guide their decisions. Examples of such information acquisition processes include medical examinations that help a doctor to decide between treatments with different profits; media consumption before voting on ethically controversial but personally costly policies; and candidate screening and interviewing by discriminatory employers on the labor market. In these decisions, when individuals decide to stop acquiring noisy information plays an important role in decision-making and the resulting welfare outcomes.

This paper makes three main contributions. (i) We *experimentally* show how individuals strategically decide when to stop acquiring noisy information about their options' externalities when an option benefits themselves. (ii) We propose a *theoretical model* that makes testable predictions about individuals' information choices in social decisions. These predictions are consistent with empirical findings, including the noisy information acquisition strategy found in our experiment. (iii) We show both in theory and in our experimental data that strategic information acquisition

motivated by selfish interests can *reduce* the negative externalities resulted from the decision. We present these three contributions in details below.

First, we conduct a laboratory experiment to investigate the acquisition of noisy information empirically. By doing so, we address three challenges that render an investigation of noisy information acquisition in the field, using observational data, difficult. First, individuals' often unknown and heterogeneous prior beliefs can act as a confounding factor; in the experiment, we fix the prior beliefs of all subjects such that they begin with the same known prior belief. Second, the information history of each individual is usually hard to monitor; our experiment allows subjects to acquire as much information as they want and monitor the entire information history of each subject. Third, the access to information and interpretation of it are often heterogeneous; the information in our experiment has a clear Bayesian interpretation and is costless for all subjects. Besides, we provide the subjects with the Bayesian posterior beliefs after each piece of information to address heterogeneous ability to interpret information rationally.

More specifically, our experimental subjects take part in a modified binary dictator game. For each dictator, contingent on an unknown binary state, one of the options reduces the payoff of the receiver, whereas the dictators know each option's outcome for themselves. Our main treatment variation is whether the two options pay the dictators equally or one option pays the dictators invariably more than the other. Before making the decision, each dictator can acquire as much noisy information as they want about which option harms the receiver. The information is costless. If one option generates a higher payoff for the dictators, they can opt for the extra payoff without a guilty conscience, as long as they believe that this option does not harm others. Whereas when the options pay themselves equally, the dictators do not have this incentive to prefer certain beliefs about the harmful option. Dictators in the latter case hence serve as the baseline.

In the laboratory experiment, we find that compared to the baseline, dictators faced with a self-benefiting option *exploit* information: when most of the information received up to that point suggests that the self-benefiting option *harms* the receivers, a higher proportion of them *continue* acquiring information; when most

2

of the information received up to that point suggests that the selfish option causes *no harm* to the receivers, a higher proportion of them *stop* acquiring information. How does this information acquisition strategy arise? Intuitively, having received dominant information suggesting that the self-rewarding option harms the receivers, the dictators become more inclined to forsake the additional payment. In this case, further information might present supporting evidence for a selfish decision favorably and make them choose the self-benefiting option instead. In contrast, having received dominant information supporting the innocuousness of the self-rewarding option, individuals face the undesirable risk that further information might challenge the previous evidence. This intuition is formalized in our theoretical model.

As the second contribution, we propose a theoretical model that analyzes the acquisition of information to all degrees of noise. It shows that the information acquisition strategy found in our experiment is optimal. In the model, a Bayesian agent who values her belief in her righteousness attempts to persuade herself to behave selfishly by strategically acquiring information. This self-persuasion modeling approach draws on the Bayesian persuasion model (Kamenica and Gentzkow, 2011). In our model, the sender and the receiver of the signal in Bayesian persuasion are the same person, namely the dictator in our experiment. The agent's signal-sender-self first chooses the information to acquire, and the information pins down her posterior belief distribution. Then the agent's signal-receiver-self chooses the option that maximizes her expected utility given the realized posterior belief. The agent's utility consists of two preference components: preferences for material gains (material utility) and preferences for beliefs that her decision does not harm others (belief utility).[1] Intuitively, in decisions with a self-benefiting option, the optimal information acquisition strategy has two properties: first the agent forgoes her self-interests only when she is certain that doing so benefits others; second, when she chooses the self-benefiting option, her marginal gain of belief utility from being more certain about the state is weakly smaller than the downside risk that the realized posterior belief leans against the self-benefiting option. Leveraging techniques from the Bayesian persuasion model of Kamenica and Gentzkow (2011), our model offers tractable tools for analyzing information acquisition. It generates rich testable

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[1]For a model with similar belief utility, see Rabin (1995).

predictions, including predictions about the welfare consequences of motivated information acquisition.

As a third contribution, we theoretically and empirically show results regarding receiver welfare that might not be obvious at first sight. Although one might consider that strategic information acquisition motivated by selfish interests must lead to more negative externalities, our model shows the opposite: for some agent types, motivated information acquisition *improves* the welfare of the others affected by the decision. Our experimental data provide evidence consistent with this prediction. This counter-intuitive result arises from a moral hazard problem: when disinterested, some agent types acquire only a small amount of information due to, for example, satisficing behavior (Simon, 1955). The agent's selfish preference for one option over the other can mitigate this moral hazard problem by causing her to choose her least-preferred option only when she is certain that it is a harmless option for others. This result implies that delegating information acquisition to a neutral investigator might lower the welfare of the others affected by the decision.

In terms of the empirical literature, this paper contributes insights into how people engage in motivated reasoning. To the best of our knowledge, we are the first to show that individuals strategically decide when to stop acquiring noisy information, even if they interpret information rationally. The existing literature on motivated beliefs has largely focused on biases in processing *exogenous* information and find that people react to exogenous information in a self-serving manner (Eil and Rao, 2011; Mobius et al., 2011; Gneezy et al., 2016; Falk and Szech, 2016; Exley and Kessler, 2018; Zimmermann, forthcoming). In the literature on excusing selfish behavior without involving information, individuals have been found to manipulate their beliefs and avoid being asked for good deeds (Di Tella et al., 2015; Haisley and Weber, 2010; DellaVigna, List, and Malmendier, 2012). An early psychology paper of Ditto and Lopez (1992) documents that individuals require less supportive information to reach their preferred conclusion, possibly due to the bias of overreacting to their preferred information. In comparison, the psychology behind our finding is the tradeoff between a more informed vs. a more desirable decision , rather than the fact that information deemed more valid leads to a conclusion faster. Our ex-

periment shows evidence that strategic information acquisition itself is used as an instrument for motivated reasoning.

Our empirical investigation of endogenous information choice relates to the empirical studies on the avoidance of perfectly revealing information in social decisions (Golman, Hagmann, and Loewenstein, 2017; Dana, Weber, and Kuang, 2007; Feiler, 2014; Grossman, 2014; Serra-Garcia and Szech, 2019). In contrast to information avoidance, we find that when it comes to noisy information, individuals *seek* further information if the previously received information by large does not support the innocuousness of their selfish interests. The avoidance of perfect information documented in the previous studies importantly reveals that individuals have information preferences in social decisions. Delving into *how* people acquire information, our investigation sheds light on *what* the individuals' information preferences are in social decisions. Our model provides a unified framework for analyzing the acquisition of information, with the avoidance of perfect information as a special case.

Another related strand of the empirical literature is the one focusing on rational inattention, showing that individuals who allocate *costly* attention rationally might make decisions based on incomplete information (e.g. Bartoš et al., 2016; Masatlioglu, Orhun, and Raymond, 2017; Ambuehl, 2017). As pointed out by Bénabou and Tirole (2016), when the nature of the decision so determines that some beliefs are more desirable than others, the decision-makers might engage in motivated reasoning and lean towards these beliefs, which is a different psychology than undirected inattention. For inattention to be rational, it is essential that information is costly. In contrast, in our experiment, information entails no monetary cost and highly limited time cost. We also limit the cognitive cost to interpret the information by providing Bayesian posterior beliefs to subjects after each piece of information.

In terms of the theory literature, we contribute to the important yet less-understood aspect of social preference: social preference under uncertainty. In social decisions with uncertainty, an expected utility-maximizing agent with intrinsic valuation for the welfare *outcome* of others always prefers complete knowledge in social decisions (for example, the agents in Andreoni, 1990; Fehr and Schmidt, 1999; Bolton and

Ockenfels, 2000; Charness and Rabin, 2002). It contradicts our empirical finding of strategic information acquisition and the avoidance of perfect information observed by, for example, Dana, Weber, and Kuang (2007). Reassessing individuals' motives in social decisions, some models deviate from outcome-based social preference. Niehaus (2014) proposes a model with an agent who receives a warm glow from her *perceived* social outcomes of her decision. Assuming that on learning nothing the agent is free to believe with full certainty in good social outcomes, the model predicts that when the state is not going to be revealed *ex-post*, the agent would always avoid information *ex-ante*.

Another strand of literature proposes self-signaling as a main concern in social decisions (Bodner and Prelec, 2003; Bénabou and Tirole, 2006; Andreoni and Bernheim, 2009; Bénabou and Tirole, 2011; Grossman and van der Weele, 2017). Assuming high level of individual rationality, these models feature intrapersonal signaling games in which one self of the agent makes decisions, including the information decision, and the other self only observes the decisions to infer her own prosocial type. Addressing *whether* people acquire perfect information, Grossman and van der Weele (2017) endogenize the decision to avoid perfectly revealing information and show that the avoidance of *perfect* information can be an equilibrium outcome in a self-signaling model. In contrast, we model the process of information acquisition as a person persuading herself to behave selfishly. Levering insights from Bayesian persuasion, our model is tractable. It goes beyond the binary decision of acquiring or avoiding a certain type of information and characterizes the optimal information acquisition strategies regarding a large range of information environments.

The rest of the paper is organized as follows: In Section 2, we first detail the experimental design and then empirically analyze the dictators' information acquisition strategy in our experiment. In Section 3, we present a theoretical model that predicts our empirical findings. In Section 4, we show theoretically that strategic information acquisition motivated by the dictator's selfish interests can improve the receiver welfare. We also provide consistent results in our experimental data. In Section 5, we conclude and propose some ideas for future research.

6

2   Motivated Information Acquisition

This Section focuses on how individuals acquire information about their options'
externalities in a decision. In Section 2.1, we provide details of the experimental
design. In Section 2.2, we empirical analyze the dictators' information acquisition
strategies.

2.1   A Laboratory Experiment With Modified Dictator Games

We conduct a laboratory experiment with modified binary dictator games. Contin-
gent on an unknown state, one of the two options of the dictator game reduces the
receivers' payoffs, and the other does not. Before deciding, the dictators can acquire
information about the harmful option at no cost.

2.1.1   The Treatment Variations

Our experiment has a 2×2 design and 4 treatments, as illustrated in Table 1. The
treatments vary on two dimensions: (i) whether one of the dictator game options
increases the dictators' own payoffs; (ii) whether the dictators can proceed to the
dictator game without acquiring any information on the externalities of their options.

The key treatment variation in our experiment is whether the dictators' selfish
interests are concerned in the dictator game. In the '*Tradeoff*' treatments, one
option increases the dictators' payoffs, while the other does not. In the '*Control*'
treatments, both options do not affect their own payoffs. The comparison between
the *Tradeoff* and *Control* pins down the causal effect of having a self-benefiting
option on the dictators' information acquisition behavior. We describe the details
of this treatment variation below when we present the dictator game.

The second treatment variation concerns the dictators' freedom to acquire no
information. It serves two purpose: (i) in the '*NoForce*' treatments, dictators are
not forced to acquire any information. These treatments allow us to examine the
proportion of dictators who do not acquire any information, but they also leave room
for self-selection into the information processes. (ii) in the '*Force*' treatments, the

7

dictators are *forced* to acquire at least one piece of information before the dictator game. This modification eliminates the potential self-selection into the information process.[2]

Table 1: Treatments

	With Selfish Interests	No Selfish Interests	Shorthand
No Forced Draw	*Tradeoff–NoForce*	*Control–NoForce*	***NoForce***
A Forced Draw	*Tradeoff–Force*	*Control–Force*	***Force***
Shorthand	***Tradeoff***	***Control***	-

This table presents our four treatments with a two by two design. *Tradeoff* vs. *Control* is our key treatment variation. Dictators' in *Tradeoff* can gain additional payment by choosing a particular option in the modified dictator game, while those in *Control* cannot. *Force* vs. *NoForce* differ in that in the former the dictators have to acquire at least one piece of information, while in the later they can choose to acquire no information.

2.1.2 The Dictator Game

	Good state (x harmless)	Bad state (y harmless)
x	$(\mathbf{0}, 0)$	$(\mathbf{0}, -80)$
y	$(0, -80)$	$(0, 0)$

(a) *Control* Treatments

	Good state (x harmless)	Bad state (y harmless)
x	$(+\mathbf{25}, 0)$	$(+\mathbf{25}, -80)$
y	$(0, -80)$	$(0, 0)$

(b) *Tradeoff* Treatments

These tables present the dictator games in *Control* and *Tradeoff* treatments. The number pairs in the table present (dictator's payment, receiver's payment).

Table 2: Dictator Decision Payment Schemes

Table 2 presents the payment scheme of the dictator game in the *Tradeoff* and the *Control* treatments respectively. In all treatments, the dictators choose between two options, x and y. There are two states of the world, *'x harmless'* or *'y harmless'*. Depending on the state, either option x or y reduces the receivers' payments by 80 points, while the other one does not affect the receivers' payment. Note that each option harms the receiver in one of the states. This makes sure that the dictators

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[2]We explain in details this selection effect when we analyze the data in Section 2.2.

cannot avoid the risk of harming the receiver without learning the state. In *Control*, the dictators receive no additional points regardless of their choices and the state. In *Tradeoff*, x is self-benefiting for the dictators: they receive 25 additional points when choosing x, but no additional points when choosing y.

Good State vs Bad State. For the ease of exposition, we hereafter refer to the state *'x harmless'* as the *'Good state'*, and the state *'y harmless'* as the *'Bad state'*. This is because in state *x harmless*, the dictator's and the receiver's interests are aligned in *Tradeoff*: option x is better for both of them. The dictator can claim the additional payment of 25 points without harming the receiver. Reversely, in state *y harmless*, if the dictator decides to choose x to gain the additional payment, she makes the receiver worse-off. The dictator is in a dilemma between less payment for herself or hurting the receiver. Although this contrast between states does not apply to the *Control* treatments, we will refer to *'x harmless'* as the *Good state* and *'y harmless'* as the *Bad state* for consistency.

Note that in treatments *Tradeoff*, dictators would prefer to believe that they are in the *Good state*, such that they can choose option x and gain the additional payment without having a bad conscious. Whereas in the *Control* treatments, dictators are indifferent about which state they are in, since their own payments are not affected by their decisions in either state.

The dictators start the experiment without knowing which state they are in. They only know that in every 20 dictators, 7 are in the *Good state*, and 13 are in the *Bad state*. That is, the dictators start the experiment with a prior belief of 35% on that they in the *Good state* and 65% in the *Bad state*. Before making the decision, they can update their beliefs by drawing information described in the next subsection.

2.1.3   The Noisy Information

We design a noisy information generator for each state, which generates information that can be easily interpreted according to the Bayes' rule. Specifically, each piece of information is a draw from a computerized box containing 100 balls. In *Good*

Figure 1: The Noisy Information Generators
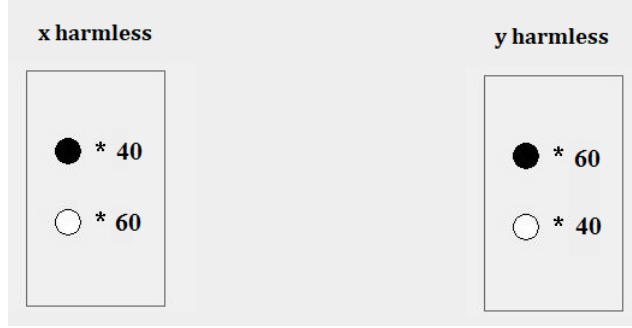
state, 60 of the balls are white and 40 are black; in *Bad state*, 40 balls are white and 60 are black (Figure 1). The draws are with replacement from the box that matches to each dictator's actual state. After each draw, we display the Bayesian posterior belief on the individual computer screen, in order to reduce the cognitive cost of interpreting the information and reduce non-Bayesian updating.

Good News vs Bad News For the ease of exposition, hereafter we refer to a white ball as a piece of 'good news', and a black ball as a piece of 'bad news'. This is because in the *Good state*, dictators draw a white ball with a higher probability. A white ball hence supports the dictators to believe in the *Good* state, in which the dictators in treatments *Tradeoff* can choose x and gain the additional payment without reducing the payment of the receiver. Reversely, in the *Bad state*, dictators would draw a black ball with higher probability. A black ball is evidence for the *Bad* state, in which option x rewards the dictators in *Tradeoff* at the cost of the receivers. Although dictators in *Control* do not have a preference over the two states, and hence unlikely to have preference for black or white balls, we will still refer to a white ball as good news and a black ball as bad news for consistency.

2.1.4 The Experimental Procedure

The experiment consists of three parts: preparation stage, main stage, and supplementary stage.

Preparation Stage: (i) The dictators read paper-based instructions on the dictator decision, and the noisy information. (ii) We also provide a description of the Bayes rule and tell the dictators that later in the experiment, we are going to help them to interpret the information by showing them the Bayesian posterior beliefs after each ball that they draw. (iii) In addition, the instructions specify that each experiment participant starts the experiment with 100 points of endowment. (iv) We also inform them that option x is harmless for 7 out of 20 of the dictators and y for 13 out of 20. That is, the dictators' prior beliefs on the states are 35% and 65% on the *Good* state and the *Bad* state.

After reading the instructions, the dictators answer 5 control questions designed to check their understanding of the instructions. They kept the paper instructions for reference through out the experiment.

Figure 2: Screenshot of the Information Stage
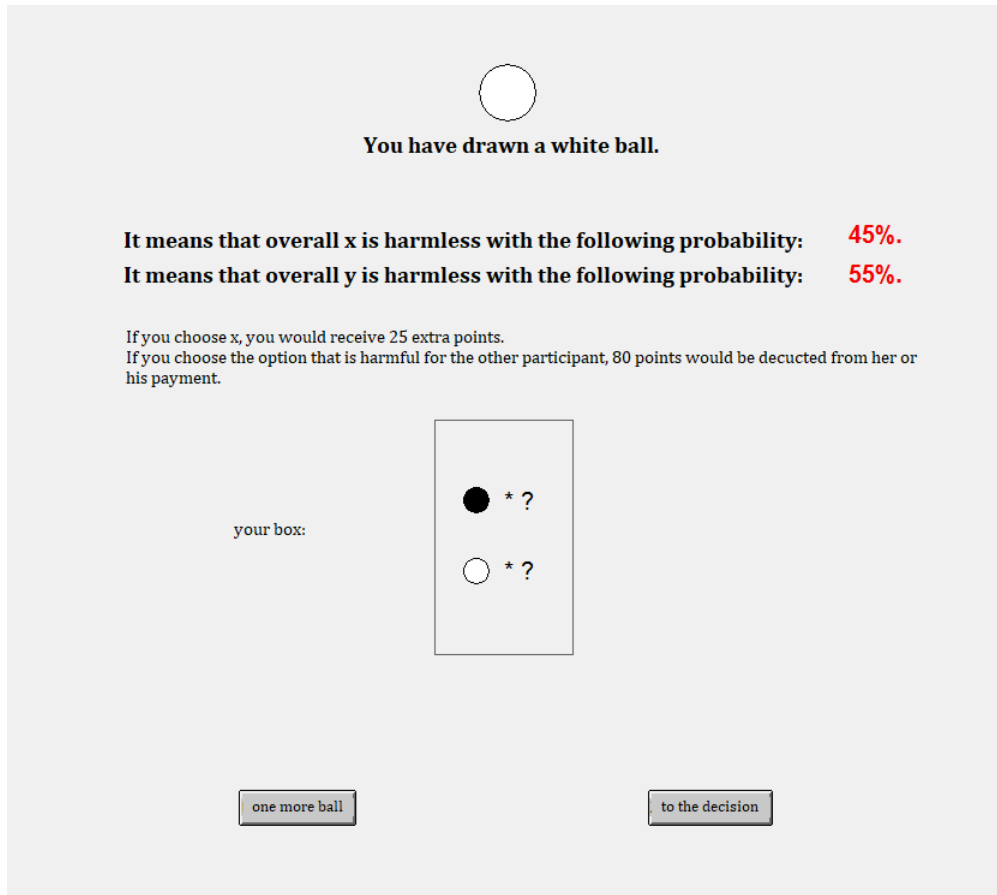
Main Stage: In the main stage, (i) dictators can acquire information about the state that their are individually in; (ii) they choose between x and y in the dictator game.

Specifically, the dictators can acquire a piece of information by clicking a button that makes the computer draw a ball randomly from the box matched to their individual actual state (the boxes see Section 2.1.3 Figure 1). The draws are with replacement. After each draw, the screen displays the latest ball drawn and the Bayesian posterior beliefs on the *Good state* and the *Bad state* given all the balls drawn so far (rounded to the second decimal, see Figure 2). There are two buttons on the screen: one to draw an additional ball, and the other to stop drawing and proceed to the dictator game. Either to draw a ball or to stop drawing, a dictator must click one of the buttons.

The draws do not impose any monetary cost on the dictators. The time cost of acquiring information is limited: between draws there is a mere 0.3 second time lag to allow the ball and the Bayesian posterior belief to appear on the computer screen. It means that a dictator can acquire 100 balls within 30 seconds, which would almost surely yield certainty.

In the *NoForce* treatments, the dictators can draw from zero to infinitely many balls. That is, they can proceed directly to the dictator game without drawing any ball; and if they decide to acquire information, the information acquisition can only be ended by them. In the *Force* treatments, the dictators must draw at least one ball, and after the first draw, they have full autonomy regarding when to stop drawing just like in *NoForce*. Besides drawing balls, the dictators have no other way to learn about the true state that they are in throughout the experiment. It is common knowledge that the receivers do not learn the information acquired by the dictators throughout the experiment.

Having ended information acquisition, dictators between x and y in the dictator game in Table 2a (in the *Control* treatments) or Table 2b (in the *Tradeoff* treatmentss). Next in the implementation state, the dictator' choices are implemented and the payments are calculated.

Supplementary Stage: (i) We elicit the dictators' posterior beliefs on the state after the dictator game. The belief elicitation is incentivized by the randomized Quadratic Scoring Rule. We compare the elicited and the Bayesian posterior beliefs in Appendix A.5 and find that for the majority of dictators, their elicited posterior beliefs and their Bayesian posterior beliefs coincide. (ii) The subjects take part in the Social Value Orientation (SVO) slider measure, which measures 'the magnitude of concern people have for others' and categorizes subjects into altruists, prosocials, individualists and competitive type (Murphy, Ackermann, and Handgraaf, 2011). (iii) The subjects answer a questionnaire consisting of socio-demographics, preferences, a selection of HEXACO personality inventory (Lee and Ashton, 2018), and a 5-item Raven's progressive matrices test (Raven et al., 1998). We report the details of the questionnaire in Appendix A.5.

Implementation: We randomize within each laboratory session: (i) the *Tradeoff* and *Control* treatments, (ii) the states: we randomly assign 35% of the laboratory terminals to the *Good state*, and 65% to the *Bad state*. The subjects are then randomly seated and randomly matched in a ring for the dictator game. The subjects are told that their decisions would affect the payment of a random participant in the same experimental session other than themselves. After all the subjects have decided in the dictator game the experiment moves on to the implementation stage, where we inform the subjects that the dictator game decisions are being implemented and their payments are affected according to another participant's dictator game decision. Each subject plays the dictator game only once.

We conducted the experiment in October and December 2018 at BonnEcon-Lab (*NoForce* and *Force* treatments respectively). 496 subjects took part (168 in *Tradeoff–NoForce*, 167 in *Control–NoForce*, 82 in *Tradeoff-Force* and 79 in *Control-Force*). In each treatment 35% dictators were in the *Good* state, and 65% were in the *Bad* state. Among the subjects, 35% are women and 93% are students. They are on average 24 years old, with the youngest being 16 and the oldest being 69. The subjects are balanced between treatments, with respect to gender, student status and age (see Appendix A.5). We used z-tree (Fischbacher, 2007) to implement the experiment and hroot (Bock, Baetge, and Nicklisch, 2014) to invite subjects and to

record their participation. Instructions and interfaces on the client computers were written in German, as all subjects were native German speakers.

Payments: In the experiment, payments are denoted in experiment points. One point equals 0.05 EUR. At the end of the experiment, the details of the points and the equivalent payments earned in the experiment are displayed on the individual computer screens. The subjects received payments in cash before leaving the laboratory. The total earnings of a subject were the sum of the following components: an endowment of 5 EUR, an additional 1.25 EUR if the subject was in treatments *Tradeoff* and chose x, a 4 EUR reduction if the subject's randomly assigned dictator made a decision that reduces her payments, a random payment of either 1.5 EUR or 0 for revealing their posterior beliefs, a payment ranging from 1 to 2 EUR depending on the subject's decisions in the SVO slider measure, a payment ranging from 0.3 to 2 EUR depending on the decisions in the SVO slider measure of another random subject in the same laboratory session, and a fixed payment of 3 EUR for answering the questionnaire. A laboratory session lasted on average 45 minutes, with an average payment of 11.14 Euro.

2.2 Empirical Analyses of Motivated Information Acquisition

In this section, we analyze the data from our experiment to investigate the effect of having a selfishly preferred option on how individuals acquire information about their options' externalities. The median number of balls drawn by the dictators is 6 (*Tradeoff*: 6, *Control*: 5; Mann-Whitney-U $p = 0.98$). We summarize our data in Appendix A.1 and proceed below with the analyses of the dictators' information acquisition behavior.

Do dictators acquire information?

Finding 1 *The proportion of dictators who do not acquire any information is 15% in Tradeoff–NoForce and 7% in NoForce–Control.*

In the *NoForce* treatments, where the dictators are allowed to draw no information before the dictator game, 38 out of 335 proceed to the dictator game without drawing information (*Tradeoff–NoForce:* 15%; *Control–NoForce:* 7%). Among them, in *Tradeoff–NoForce* 25 out of 26 choose x, the option with additional payments for themselves; in *Control– NoForce*, where both options do not produce additional payments for the dictators themselves, only 2 out of 12 choose x.

Table 3: Proportion of Dictators Drawing No Ball

	No Info%	Their Choices	
Tradeoff–NoForce	15%	x: 96%	y: 4%
Control–NoForce	7%	x: 17%	y: 83%
Chi-2 p-value	0.02	0.00	

This table displays in each treatment (i) the proportion of dictators who do not draw any ball before making their decisions between x and y; (ii) the proportion *among them* who choose option x. Note that in treatment *Tradeoff–NoForce*, dictators who choose option x receive additional payment, while those in treatment *Control–NoForce* do not.

## Do dictator stop earlier in *Tradeoff* than in *Control*?

Finding 2 *Overall, the proportions of dictators who continue acquiring information after each draw do not differ between treatments.*

Figure 3 presents in *Tradeoff* and *Control* the proportions of dictators surviving overtime, i.e. the proportion of dictators who are still acquiring information overtime. The survival function does not differ between *Tradeoff* and *Control* (log-rank test for equality of survivor functions, $p = .63$).

Finding 2 speaks against an overall lower propensity to acquire noisy information, when individuals' selfish interests are involved in the decision. It contrasts the avoidance of perfect information found by the previous literature (e.g. Dana, Weber, and Kuang, 2007).

Figure 3: Life Table Survival Function
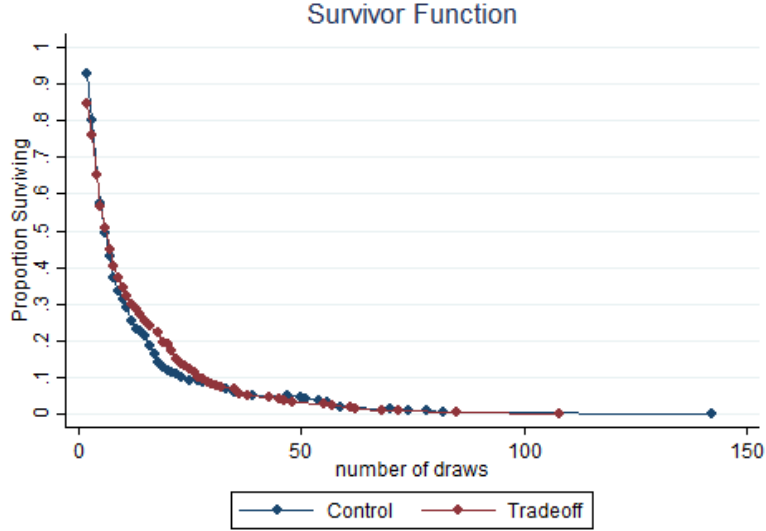
This figure plots the fraction of dictators remaining in the information acquisition process over the number of draws.

When do dictators stop acquiring information?   We now turn to the 458 dictators who did acquire information and focus on the role of the information history in their decisions to continue acquiring information after each draw of ball.

Specifically, we predict:

An option's being selfishly better for the dictators (i) increases their tendency to *continue* acquiring information, when a dominant amount of information received up to that point is *bad* news against the innocuousness of this option; (ii) but increases their tendency to *stop*, when a dominant amount of information received is *good* news supporting the innocuousness of this option.

The intuition of the prediction is that when the dictators are inclined to forgo their selfish interests upon receiving dominant bad news, continuing the inquiry might reverse the previous bad news favorably and make them choose the self-rewarding x instead. This possibility might encourage dictators to continue drawing

16

balls. However, when the dictators have received dominant desirable good news and are inclined to behave selfishly, further information might be bad news that deteriorates their current desirable beliefs. This risk might discourage the dictators from drawing further information. This intuition is formalized in the theoretical model presented in Section 3.

In what follows, we first compare between *Tradeoff* and *Control* the decisions to stop acquiring information directly after the first draw of ball. Then, we analyze the entire information histories, levering insights from the research of survival analysis.

2.2.1 The First Draw of Ball

For dictators whose first ball is good and bad news, we respectively compare between *Tradeoff* and *Control* their decisions to continue acquiring information right after the first draw. The good and bad nature of the first draw of ball is exogenous in our experiment, since the composition of the 100 balls in the boxes depend solely on the exogenous state and the draws are random. 52% dictators receive bad news up front, and this fraction is not different between *Tradeoff* and *Control* (Chi square, $p = 0.91$).

Finding 3 *(i) When the first draw is bad news, the proportion of dictators who continue drawing balls after it is similar across treatments. (ii) In case of good news, the proportion is smaller in Tradeoff treatments than in Control treatments.*

Finding 3 shows evidence that one option's being self-rewarding causes individuals to be more likely to stop acquiring further information, when the previous information supports the innocuousness of this option. On the opposite, when the information received suggests that behaving selfishly harms others, individuals continue acquiring information in a similar manner. Table 4 and Figure 4 present the exact proportions of dictators who continue acquiring information right after the first draw.

Discussion Finding 3 is less prominent in the *NoForce* treatments, where the observations can choose to draw no information. The reason might be the fact

17

Table 4: Proportion of Dictators Continuing After the First Ball

Treatment	First News **Good**			First News **Bad**		
	Pooled	*Force*	*NoForce*	Pooled	*Force*	*NoForce*
Tradeoff	83%	79%	86%	91%	93%	90%
Control	97%	97%	97%	85%	88%	85%
Chi-2 p-value	.00	.01	.00	.26	.52	.22

This table displays the proportions of dictators who continue acquiring information after the first draw of ball in the respective treatment, given the respective first draw. In the *Force* treatments, dictators have to draw at least one ball before choosing between x and y. Note that in the *Control* treatments the within treatment differences given different news are due to the asymmetric asymmetric prior belief of 35% in the *Good* state.

Figure 4: Proportion of Dictators Continuing after the First Draw

(a) Pooled Data   (b) *Force* Treatments   (c) *NoForce* Treatments
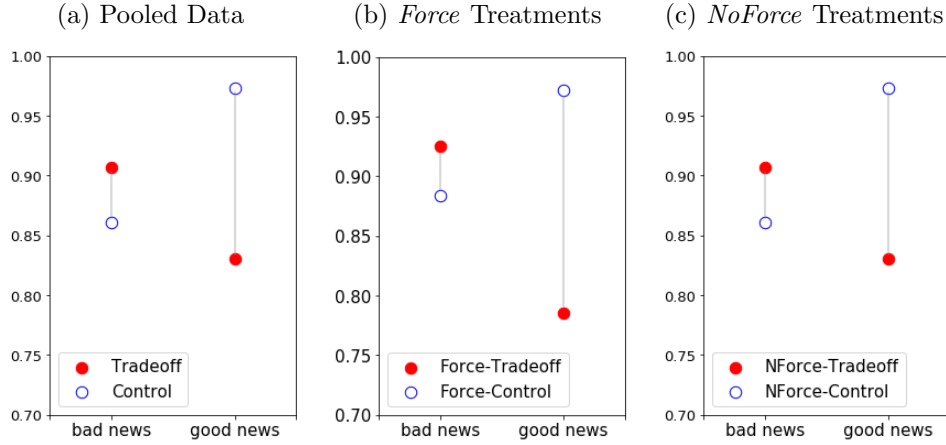
These figures present the proportion of dictators who continue acquiring information after the first draw of ball.

that the observations here in *NoForce* have selected themselves into the information process. In *Tradeoff–NoForce*, almost all dictators who do not acquire information choose x directly. Had they received a further piece of good news, they would also be willing to stop immediately. Therefore, the *Tradeoff–NoForce* dictators' sorting out of the information process decreases the proportion of them who stop directly after the first good news, and reduces the observed effect of the treatment. Similarly, in treatment *Control–Force*, almost all dictators who do not acquire information choose y directly. Had they received a piece of bad news, they might also stop

immediately to choose y. Therefore, the *Control–Force* dictators' self-selecting out
of the information process decreases the observed proportion of them who stop right
after the first bad news, and hence is also against our finding.

2.2.2 The Entire Information Histories

Now we turn to the dictators' complete information acquisition process. Each dicta-
tor's information history evolves over time. To be able to include it into our analyses,
we first split each dictator's complete information history at the unit of one draw.[3]
The resulting data set consists of records at the person-draw level. For every draw of
each dictator, the pseudo-observation records the dictator's information history up
to that draw, whether the dictator chooses to stop or continue acquiring information
directly after that draw and time-constant characteristics of the dictator such as her
identity, treatment assignment and gender. After each draw, we can distinguish
between information histories dominated in amount by good and bad news, using a
binary dummy variable.

In the framework of a Cox proportional hazard model, we compare the decision
to stop acquiring further information between treatments, given theses two types
of information histories: one dominated in amount by good news, and the other by
bad news.[4]

We are interested in the dictators' hazard to stop acquiring information. The
Cox proportional hazard model factors the hazard rate to stop acquiring information
into a baseline hazard function $h_0(t)$ and covariates X_t that shift the baseline hazard
proportionally, as in (1). The baseline hazard function $h_0(t)$ fully captures the time
dependency of the hazard.[5]

---

[3]Time-varying covariates in survival analysis is often obtained by the method of splitting
episodes (see Blossfeld, Rohwer, and Schneider, 2019, pp 137-152).

[4]The Cox model has the advantage that its coefficient estimates can be easily interpreted. We
report a robustness check using the logistic model in Appendix A.4. The results of the logistic
model are in line with those of the Cox model.

[5]Unlike many other regression models, the Cox model naturally includes no constant term,
since the baseline hazard function already captures the hazard rate at covariate vector 0 (see for
example Cleves et al., 2010).

$$h(t|X_t) = h_0(t) \cdot exp(X_t \cdot b). \tag{1}$$

Our model specification is as follows:

$$h(t|X) = h_0(t) \cdot exp(\beta_1 \text{Tradeoff} + \beta_2 \text{Info} + \beta_{12} \text{Tradeoff} \times \text{Info} + \alpha z_t), \tag{2}$$

where 'Tradeoff' is a dummy variable for treatment *Tradeoff*, 'Info' is a categorical variable denoting information histories that are dominated by bad news, good news, or balanced between the two, with bad news dominance as the baseline. z_t is a control variable that measures the accuracy of the individual belief after each ball drawn.[6] After controlling for the belief accuracy, the color of the balls per se appears to have no significant effect on dictators' stopping decisions, as shown later in Table 5. To allow for different shape of the hazard function with respect to gender, cognitive ability (measured by Raven's matrices test) and prosocial types (categorized by SVO measure by Murphy, Ackermann, and Handgraaf (2011)), we stratify the Cox model by these variables (Allison, 2002).[7]

We are interested in the following two hazard ratios:
(i) the first one reflects the effect of the treatment on the hazard rate, given *bad* news dominance in the information history. That is, *ceteris paribus*

$$
\begin{aligned}
\text{HR}_{Bad} = \frac{h(t|\text{Bad, Tradeoff} = 1)}{h(t|\text{Bad, Tradeoff} = 0)} &= \frac{exp(\beta_1 \cdot 1 + \beta_2 \cdot 0 + \beta_{12} \cdot 1 \cdot 0 + \alpha z_t)}{exp(\beta_1 \cdot 0 + \beta_2 \cdot 0 + \beta_{12} \cdot 0 \cdot 0 + \alpha z_t)} \\
&= \frac{exp(\beta_1 + \alpha z_t)}{exp(\alpha z_t)} \\
&= exp(\beta_1); \tag{3}
\end{aligned}
$$

(ii) the second one reflects the effect of the treatment on the hazard rate, given *good*

_____

[6]We use the following score as a proxy for the accuracy of beliefs: $\text{belief}_{\text{Good}} \times \text{belief}_{\text{Bad}}^2 + \text{belief}_{\text{Bad}} \times \text{belief}_{\text{Good}}^2$. It is a probabilistic belief's expected Brier score (Brier, 1950). Brier score is a proper score function that measures the accuracy of probabilistic predictions.

[7]As shown in Table 5, after the stratification, our main covariates affect the hazard to stop acquiring information proportionally.

news dominance in the information history. That is, *ceteris paribus*

$$\text{HR}_{Good} = \frac{h(t|\text{Good, Tradeoff} = 1)}{h(t|\text{Good, Tradeoff} = 0)} = \frac{exp(\beta_1 \cdot 1 + \beta_{2,\text{Good}} \cdot 1 + \beta_{12,\text{Good}} \cdot 1 \cdot 1 + \alpha z_t)}{exp(\beta_1 \cdot 0 + \beta_{2,\text{Good}} \cdot 1 + \beta_{12,\text{Good}} \cdot 0 \cdot 1 + \alpha z_t)}$$

$$= \frac{exp(\beta_1 + \beta_{2,\text{Good}} + \beta_{12,\text{Good}} + \alpha z_t)}{exp(\beta_{2,\text{Good}} + \alpha z_t)}$$

$$= exp(\beta_1 + \beta_{12,\text{Good}}). \tag{4}$$

Our prediction suggests that HR_{Bad} is smaller than 1 and HR_{Good} is larger than 1. That is, (i) $\beta_1 < 0$; (ii) $\beta_1 + \beta_{12,\text{Good}} > 0$.

In Table 5, we report the Cox model results, with standard errors clustered at the individual level. Pooling all treatments, the Cox model coefficient estimates yields Finding 4.

Finding 4 *(i) Having received more bad news than good news, the dictators are more likely to **continue** acquiring information in Tradeoff than in Control; (ii) while they are more likely to **stop** in Tradeoff than in Control, having received more good news than bad news.*

The estimated coefficient of the treatment dummy is $\beta_1 = -.28$ and its interaction with the categorical variable indicating good news dominance is $\beta_{12} = .43$, both significant at 5 percent level. If bad news dominates the information history, the hazard to stop acquiring information in *Tradeoff* is $exp(-.28) = .76$ of that in *Control*, i.e. 24% lower in *Tradeoff*. In contrast, if good news dominates, the hazard in *Tradeoff* is $exp(-.28 + .43) = 1.16$ of that in *Control*, i.e. 16% higher in *Tradeoff*. That is, the treatment of having a selfishly preferred option makes the dictators more likely to continue acquiring information, when they have received dominantly bad news, and more likely to stop, when they have dominantly good news. The estimation in the *Force* and *NoForce* treatments point in the same direction.

The Role of Cognitive Ability When we focus exclusively on dictators above the median cognitive ability (Table 6), as measure by the Raven's matrices test, we find that the effects in Finding 4 become *stronger* than the average effect that we

report in Table 5. Having received more bad news, these dictators' hazard to stop acquiring information in *Tradeoff* is $exp(-.35) = 70\%$ of that in *Control*. Having received more good news, the hazard to stop acquiring information in *Tradeoff* is $exp(-.35 + .59) = 130\%$ of that in control. In comparison, considering all dictators, these numbers are 76% and 116%, indicating that the tendency to acquire information strategically is more moderate averaging across dictators with all levels of cognitive ability than focusing on the ones with high cognitive ability. This finding suggests that the information acquisition behavior in Finding 4 is more likely out of strategic considerations than due to limited cognitive abilities.

Table 5: The Cox Proportional Hazard Model Results

		Pooling All		Force	NoForce
$\hat{\beta}_1$	treatment *Tradeoff*	-.28**	-.24*	-.38*	-.18
		(.12)	(.13)	(.21)	(.16)
$\hat{\beta}_{12}$	Tradeoff ×				
	Good news dominance	.43**	.41**	.32	.42*
		(.20)	(.21)	(.39)	(.26)
	Balanced	-.35	-.42	-.59	-.34
		(.38)	(.38)	(.69)	(.47)
$\hat{\beta}_2$	Good news dominance	-.14	-.23	-.18	-.23
		(.16)	(.12)	(.31)	(.22)
	Balanced	-.51**	-.56**	-.48	-59**
		(.24)	(.22)	(.38)	(.30)
Control Variables:					
Belief Accuracy		Yes	Yes	Yes	Yes
Gender, IQ, Prosociality FEs		Yes	Yes	Yes	Yes
Force treatment FE		No	Yes	–	–
Observations (individuals)		458	458	161	297
Chi2 p-value		.00	.00	.00	.00
Violation of PH		NO	NO	NO	NO

This table presents the estimated *coefficients* of the Cox model in (2), with standard errors clustered at the individual level. *, **, and *** denote significance at the 10, 5 and 1 percent level. The dependent variable is the hazard to stop acquiring information, and the key coefficients of interests are $\hat{\beta}_1$ and $\hat{\beta}_{12}$. $\exp(\hat{\beta}_1)$ reflects the treatment effect on the dictators' hazard to stop acquiring further information, given information histories dominated by bad news. And $\exp(\hat{\beta}_1 + \hat{\beta}_{12}|\text{Good news dominance})$ reflects the treatment effect on the hazard, given information histories dominated by good news (derivation see equation (4)).

The fixed effects are taken into account by stratification, which allows the baseline hazard to differ according to the control variables, i.e. gender, the prosocial types (categorised by the SVO test) and the cognitive ability (measured by in the Raven's matrices test). We also control for the belief accuracy, measured by the Brier score of the beliefs after each draw (see footnote 6). The reported likelihood Chi-square statistic is calculated by comparing the deviance ($-2\times$ log likelihood) of each model specification against the model with all covariates dropped. The violation of the proportional hazard assumption (PH) is tested using Schoenfeld residuals. In all four cases the PH is not violated for each individual covariate nor globally. We use the Breslow method to handle ties.

Table 6: The Cox Model Results For Above and Below Median Raven's Scores

		Above Median	Below Median
$\hat{\beta}_1$	treatment *Tradeoff*	-.35**	-.17
		(.16)	(.20)
$\hat{\beta}_{12}$	Tradeoff ×		
	Good news dominance	.59**	-.21
		(.27)	(.30)
	Balanced	.32	-1.03*
		(.54)	(.59)
$\hat{\beta}_2$	Good news dominance	-.10	-.25
		(.22)	(.27)
	Balanced	-.98**	-.21
		(.40)	(.32)
Control Variables:			
Belief Accuracy		Yes	Yes
Gender, IQ, Prosociality FEs		Yes	Yes
Force treatment FE		No	Yes
Observations (individuals)		267	191
Chi2 p-value		.00	.00
Violation of PH		NO	NO

This table presents the Cox model results for the subjects above and below median cognitive ability, measured by the number of correctly answered questions in the Raven's matrices test, pooling data from all treatments. Standard errors are clustered at the individual level. The median number of correct answers to the Raven's test is four out of five in our experiment. In the this table, the subjects above median have given correct answers to four or five questions in the Raven's test, and the subjects below median have correctly answered below four questions in the Raven's test. We find that subjects with higher cognitive ability have a higher tendency to acquire information strategically. For a comprehensive table description please see that of Table 5.

3 Optimal Information Acquisition in Theory

In this section, we present a model that characterizes individuals' optimal information choices in decisions affecting others. Its predictions include the noisy information acquisition strategy found in Section 2.2 and the avoidance of perfect information evidenced by Dana, Weber, and Kuang (2007) (see Appendix B.1).

Heavily drawing on the Bayesian persuasion model (Kamenica and Gentzkow, 2011), we assume Bayesian updating and transform the problem of information acquisition to the problem of *self-persuasion*.[8] We compare the optimal information acquisition strategy between two scenarios: a decision in which one of the options benefits the agent herself (like in treatments *Tradeoff*), and a decision in which her own benefits are not concerned (like in treatments *Control*).

To make the idea of *self-persuasion* concrete, let us consider the dictators in our experiment and answer two questions. First, which option would the dictators persuade themselves to choose? In treatment *Control*, the payment of a dictator is not affected by her choice between the two options x and y. She hence has no incentive to persuade herself of either of the option. Only in treatment *Tradeoff* where a dictator receives additional payment for choosing x, the dictator has the incentive to persuade herself to choose x.

Second, why would a dictator in treatment *Tradeoff* need self-persuasion at all? If she cares more about her own payment, she can simply choose x to claim the additional payment, without drawing any information. Or if she cares more about the receiver's payment, she can acquire information until she is sufficiently certain about the state, and decide accordingly. Our observation that the majority of dictators in treatment *Tradeoff* do nether of the above points at a third possibility – while care for their own payments, the dictators also want to *believe* that they are not harming the receivers. This is where self-persuasion comes into play. Although the problem concerns only one person, i.e. the dictator, we can understand her as having two selves: a *Sender-self* who affects her beliefs by acquiring information,

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[8]In the experiment, we facilitate Bayesian updating by providing the dictators with the Bayesian posterior beliefs after each draw of information.

but does not make the decision between x and y; and a *Receiver-self* [9] who has a plan regarding which option to choose given any belief in the states, she is the self making the dictator decision. By acquiring information, the dictator's *Sender-self* sends signals to persuade her *Receiver-self* to choose the self-benefiting option x.

Information can be used by an individual's *Sender-self* to persuade her *Receiver-self* to make a certain decision because it affects her beliefs. For example, in our experiment, information influences the dictator's belief in the state, which in turn affects her decision between x and y. A Bayesian agent's beliefs only change when responding to information. When committing to acquiring information in a certain way, a Bayesian agent is committing to a distribution of her posterior beliefs. A Bayesian agent can choose any distribution of posterior beliefs that is Bayes-plausible, i.e. any posterior belief distributions with expectation equal to her prior belief.

To illustrate how information persuades, consider a dictator in treatment *Trade-off* whose *Receiver-self* chooses x whenever her belief in the *Good* state is not lower than 40%. Recall that her prior belief in the *Good* state is 35%. Hence without information, this *Receiver-self* would choose y. By acquiring information, the dictator's *Sender-self* can with some probability make her *Receiver-self* choose x instead. For example, if the *Sender-self* sends her *Receiver-self* full information that reveals the state completely, the *Sender-self* has a 35% chance to persuade her *Receiver-self* to choose x. By not acquiring full information, the *Sender-self* can do even better. For example, by choosing an information acquisition strategy that yields either 70% or 0% posterior belief in the *Good* state, she can persuade her *Receiver-self* to choose x 50% of the time, i.e. whenever 70% posterior is realized. By reducing the certainty in the *Good* state for which the *Sender-self* makes the *Receiver-self* choose x, the *Sender-self* can increase the probability of successful persuasion. However, the downside of doing so is that she would be less certain that she is not harming others when choosing x – her belief utility when choosing x is reduced. The optimal information acquisition strategy is determined by tradeoffing off the probability of successful persuasion and the belief utility of being certain that the decision does

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[9]The *Receiver-self* is to be distinguished from the receiver in the dictator game. The former refers to the receiver of signals in the Bayesian persuasion model (Kamenica and Gentzkow, 2011).

not harm others.

Our model analyzes the optimal information acquisition strategy for an agent to persuade herself to choose a selfish option, when she also wants to believe that her decision does not harm others. We focus on binary action space and binary state space, like in our experiment. The optimal information acquisition strategies in the model are in line with our empirical findings in the experiment.

In Section 3.1, we set up a model. In Section 3.2, we compare in the model the optimal information acquisition in two scenarios: one in which the receiver's choice solely affects a third person; one in which a certain option benefits the decision maker herself. Finally in Section 3.3, we show in our data direct evidence of the model predictions.

3.1   Setup of the Model

An agent (she) has to make a decision between two options x and y. There is an unknown binary state $\omega \in \{X, Y\} = \Omega$ and the prior belief is that the probability of X is $p_0 \in (0, 1)$. A passive agent, whom we hereafter refer to as *the other* (he), can be affected by the agent's decision between x and y – when the agent chooses an action that does not match the state, i.e. x in Y or y in X, the action has a negative externality of -1 on the other (he) and otherwise not.[10] The agent dislike the belief that her decision harms the other. When the agent believes that state X holds with probability p and chooses $a \in \{x, y\}$, her utility is given by

$$U(a, p; r) = \begin{cases} u(p) + r & \text{if} \quad a = x \\ u(1 - p) & \text{if} \quad a = y. \end{cases} \tag{5}$$

[10]The negativity of the externality is only a matter of normalization. Our model applies to all situations where one of the options is better for the other agent, and one worse.

If choosing x, she receives a state-independent *remuneration* $r \geq 0$[11] and belief utility $u(p)$ for believing that her choice x is harmless for the other agent with probability p. The belief utility u is weakly increasing, and continuously differentiable; we normalize $u(1) = 0$. If choosing y, she only receives belief utility $u(1 - p)$ for believing that her choice y is harmless for the other with probability $1 - p$. We call u the *(other-regarding) preference type* of the agent.

Before deciding between x and y, the agent has unrestricted access to information about the state at no cost.[12] Formally, she can choose any *signal structure*, i.e. a joint distribution of a set of signals $s \in S$ and the state. For any signal structure, the distribution of her posterior beliefs $\Pr(X|s)$ conditional on the realized signal s must be Bayes-plausible.[13] In the following, we model her choice of a signal structure as the choice of a posterior beleif distribution $\tau \in \Delta(\Delta(\Omega))$ from the set of Bayes-plausible distributions.[14] After choosing τ, a posterior $p \in \text{supp}(\tau)$ is drawn by nature and privately observed by the agent. Then, she decides on $a \in \{x, y\}$ to maximize her utility given the realized posterior belief p.

Preliminaries. A posterior belief determines the utility in two steps. First, it determines the agent's choice of option between x and y – the agent chooses the action that maximizes $U(a, p; r)$ for any given belief. Then it together with the chosen option determines the utility. Hence, we can get rid of the argument a in the utility function and directly expressing utility as a function of posterior belief p

$$V(p; r) = \max_{a \in \{x, y\}} U(a, p; r). \tag{6}$$

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[11]A remuneration $r > 0$ might arise in situations where she receives a choice-contingent monetary payment, e.g. a commission, a prize or it might arise from choice-contingent non-monetary rewards, e.g. an increase in the reputation within a group or the feeling of satisfaction from a particular choice.

[12]Later, in the Online Supplement, we describe how the model naturally generalizes to the situation when information is costly.

[13]A distribution of posteriors is called Bayes-plausible if the expected posterior equals the prior, that is $\sum_{p \in supp(\tau)} p \Pr_\tau(p) = p_0$.

[14]It has been shown in the literature on Bayesian persuasion (Kamenica and Gentzkow (2011)) that in fact the model where she can choose any signal structure and the model where she can choose any Bayes-plausible distribution of posteriors are equivalent. This is, because, for any Bayes-plausible distribution of beliefs τ, there is a signal structure such that the distribution of posterior belief $\Pr(X|s)$ is τ.

$V(p; r)$ is the continuation value for any posterior realization p given remuneration r. The optimal posterior belief distribution τ is the one maximizing her expected continuation value, i.e.

$$E_\tau V(p; r) = \sum_{p \in \mathrm{supp}(\tau)} \mathrm{Pr}_\tau(p) V(p; r). \tag{7}$$

Before analyzing the optimal posterior beleif distribution, we first narrow down the space of the optimal τ in Lemma 1. It shows that for any other-regarding preference type, there exists an optimal posterior distribution τ^* that is supported on *two* (potentially identical) beliefs $\underline{p} \leq \overline{p} \in [0, 1]$. We show in the proof of Lemma 1 that the agent chooses x when her posterior belief realizes as $\overline{p}$ and chooses y when her posterior realizes as $\underline{p}$, whenever $\underline{p} < \overline{p}$. The proof is in the Appendix.

Lemma 1 *For any $r \geq 0$ and any u, there is an optimal posterior distribution τ^* with binary support $\mathrm{supp}(\tau^*) = \{\underline{p}, \overline{p}\}$ and $\underline{p} \leq p_0 \leq \overline{p} \in [0, 1]$, where p_0 is the agent's prior belief.*

3.2 The Optimal Information Acquisition Strategy

In this section, we compare the optimal belief cutoffs $\underline{p}$ and $\overline{p}$ in the scenario without a remuneration ($r = 0$) and in the scenario with a remuneration ($r > 0$). Theorem 1 shows that, for *all* preference types that acquire at least some information in both scenarios, both belief cutoffs $\underline{p}$ and $\overline{p}$ are weakly smaller when there is a remuneration for option x, i.e. $r > 0$.

Theorem 1 *Take any u and any optimal belief cutoffs $(\underline{p}^{co}, \overline{p}^{co})$ given $r = 0$. If it is not optimal to acquire no information given $\bar{r} > 0$, then for any optimal belief cutoffs $(\underline{p}^{tr}, \overline{p}^{tr})$ given $\bar{r} > 0$,*

$$\underline{p}^{tr} \leq \underline{p}^{co}, \tag{8}$$

$$\overline{p}^{tr} \leq \overline{p}^{co}. \tag{9}$$

The formal proof is in the Appendix, while the intuition is elaborated below. Note that the statement of the theorem is trivially true when the agent's belief utility u is weakly convex: no matter $r = 0$ or $r > 0$, she always strictly prefers accurate beliefs and acquires all possible information, i.e. $\underline{p}^{tr} = \underline{p}^c = 0$ and $\overline{p}^{tr} = \overline{p}^c = 1$. Our empirical finding that most of the dictators stop acquiring information when their beliefs are far from certainty suggests that the belief utility is likely concave. The concavity of the belief utility captures the following psychological mechanism: it is increasingly more uncomfortable for the individual to choose an option, as she becomes more certain that her chosen option is the one worse for the other.

The intuition of this theorem goes back to the observation that only an agent in scenario $r > 0$ wants to persuade herself to choose x. Lower $\overline{p}$ and lower $\underline{p}$ both make the agent to choose x with a higher probability. Recall that she choose x only if the upper cutoff $\overline{p}$ is realized. To increase the probability that she chooses x, she has to increase the probability that the upper cutoff $\overline{p}$ is realized. There are two things that our Bayesian agent can do to increase the probability of the upper cutoff being realized. First she can require lower certainty to choose x, i.e. reduce the upper cutoff $\overline{p}$, such that it is realized with higher probability. Second she can require higher certainty to choose y, i.e. reduce the lower cutoff $\overline{p}$, such that the lower cutoff is realized with lower probability.

While the model does not restrict the information environment of the agent, our experiment focuses on information environments in which the decision-makers can sequentially acquire noisy information and freely decide when to stop. These information environments are approximated by the feature of unrestricted access to information in our model. The optimal belief cutoffs $(\underline{p}, \overline{p})$ of our model translate into the following dynamic behaviour in the experiment: an dictator chooses *belief cutoffs* $\underline{p}$ and $\overline{p}$ and acquires information until her belief reaches either $\overline{p}$ or $\underline{p}$. She then chooses x if $\overline{p}$ is reached, and y if $\underline{p}$ is reached.[15] Theorem 1 is in line with our empirical findings from the laboratory experiment, i.e. when most of the information received so far indicates that the remunerative option x is *harmless* to

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[15]Note that an equivalence between static persuasion models and dynamic information acquisition models in the presence of information cost has been shown formally in Morris and Strack (2019).

others ($p > p_0$), weakly more dictators in treatment Tradeoff ($r > 0$) stop acquiring information; when most of the information received so far indicates that the remunerative option x is *harmful* to others ($p < p_0$), weakly less dictators in treatment Tradeoff ($r > 0$) stop acquiring information.

In finer details, Theorem 1 can be understood by considering the optimal information acquisition strategy in scenario $r = 0$ and $r > 0$ respectively. We first introduce an important value of belief

$$l = \min\{q : u(q) = 0\}.$$

$l \leq 1$ is the threshold above which any further certainty that her chosen option is harmless does not increase her belief utility any more.[16] Whereas when her belief that the option chosen is harmless is lower than l, her utility increases when she gains additional certainty that the option is harmless. We term l the agent's *moral standard*. A moral standard $l < 1$ captures the idea of satisficing – the agent is 'satisficed' if she is certain with l probability that her choice of option does not harm others, and any further certainty on longer brings her additional utility.

Figure 5a illustrates $V(p)$ in the scenario without remuneration, i.e. $r = 0$. The agent's only concern is her belief utility u. Whenever she is more certain than her moral standard that her decision does not harm the other ($\underline{p}^c < 1 - l$ or $\overline{p}^c > l$), her belief utility is at its highest value 0. Therefore, any information acquisition strategy that always makes her more certain in the state than her moral standard is optimal for her. Formally:

Theorem 2 *When $r = 0$, any cutoff pair $(\underline{p}^c, \overline{p}^c)$ with $\underline{p}^c \in [0, 1 - l]$ and $\overline{p}^c \in [l, 1]$ is optimal.*

Next, we turn to the optimal cutoffs when x is remunerative, i.e. $r > 0$.

In the presence of remuneration, the agent values her belief utility that she does
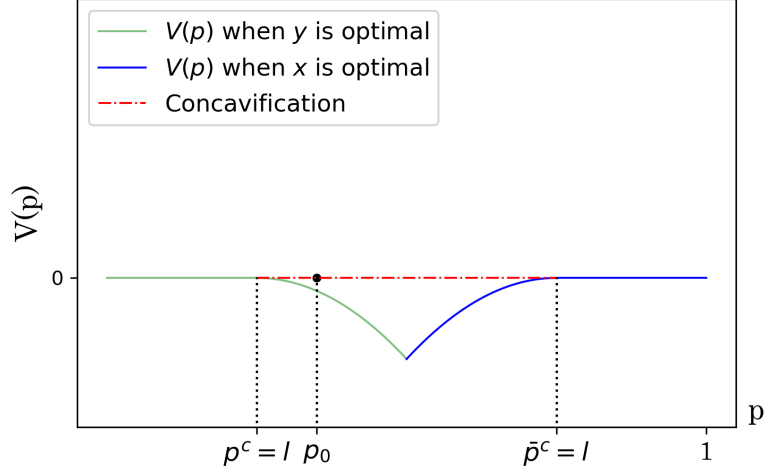
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[16]See Simon (1955) for seminal literature on satisficing. The interesting feature of the satisficing behavior in our setting is that the agent exhibits satisficing behavior with respect to beliefs, instead of outcomes.
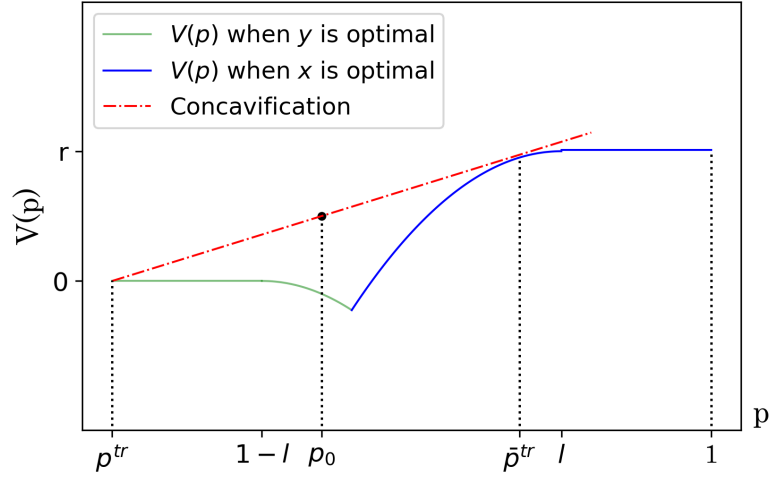
Figure 5: Illustration of Optimal Cutoffs

(a) $l < 0$ and $r = 0$

(b) $l < 0$ and $r > 0$

no harm on the other, as well as the remuneration utility r given by choosing x. Regarding $\underline{p}^{tr}$, we first observe that the agent chooses the non-remunerative option y only if she is certain that y is the option harmless to the other, i.e. $\underline{p}^{tr} = 0$. This is because if choosing y for any $\underline{p}^{tr} > 0$, she can always improve her belief utility by choosing y at $\underline{p}^{tr} = 0$. Meanwhile, $\underline{p}^{tr} = 0$ minimizes the probability that $\underline{p}^{tr}$ is realized, *ceteris paribus*, so that she can choose the remunerative option x with the highest probability. Theorem 2 shows that $\underline{p}^c \in [0, 1 - l]$. Therefore, like Theorem

1 shows, $\underline{p}^{tr} \leq \underline{p}^c$.

Regarding $\overline{p}^{tr}$, when she considers choosing the remunerative option x, she faces a tradeoff: on the upside, she appreciates higher $\overline{p}^{tr}$, as it increases her belief utility from believing that x is harmless with higher certainty; on the downside, the higher $\overline{p}^{tr}$ is, the lower is the probability that it is realized, and hence the lower is the probability that she can choose x. The optimal cutoff $\overline{p}^{tr}$ is determined by this tradeoff.

Among those who acquire information, there are two classes of agent types. The types in the first class acquire complete information given $r > 0$.[17] These types must have moral standard $l = 1$, i.e. the are not satisfied by any belief lesser than certainty. In addition, their value additional certainty in their beliefs so much that their marginal belief utility still exceeds the remuneration r even when their belief is already very close to certainty. Since their moral standard is equal to 1, these types also acquire complete information when $r = 0$. Hence for them, $\overline{p}^{tr} = \overline{p}^c = 1$, consistent with Theorem 1.

The second class of types does not acquire complete information. Next, we will show that for the types who do not acquire complete information, $\overline{p}^{tr} < \overline{p}^c$, in line with Theorem 1. We first formally express the tradeoff between the belief utility and the risk of the undesirable realization of $\underline{p}^{tr}$. Recall the agent's maximization problem (7); given that $\underline{p}^{tr} = 0$[18] and $V(0) = 0$, her maximization problem is

$$\overline{p}^{tr} = argmax_{p \in [p_0, 1]} \Pr(p) V(p; r), \tag{10}$$

subject to the Bayes-plausibility constraint. Bayes-plausibility, together with $\underline{p}^{tr} = 0$, implies that $\Pr(\overline{p}^{tr}) = \frac{p_0}{\overline{p}^{tr}} \in [0, 1]$. The first-order condition is therefore

$$Pr(p) u'(p) + \frac{\partial Pr(p)}{\partial p} V(p; r) = 0 \tag{11}$$

$$\Leftrightarrow \frac{p_0}{p} u'(p) - \frac{p_0}{p^2} V(p; r) = 0$$

---

[17]Formally they are those who satisfy the condition $u'(1) \geq r$. $u'(1) \geq r$ implies that $l = 1$. Since u is continuously differentiable, if $l < 1$, then $r > u'(1) = 0$.

[18]Proof see Appendix.

$\bar{p}^{tr}$ is the solution to (11). The intuition of (11) is that the its first term describes the marginal increase in belief utility u for being more certain that the chosen option x is harmless; and its second term captures the marginal undesirable risk that higher information can make the remunerative option unacceptable.

Figure 5b illustrates the problem geometrically. It is easy to see in (11) that its solution $\bar{p}^{tr}$ is where the linear line connecting point $(0,0)$ and point $(\bar{p}^{tr}, V(\bar{p}^{tr}))$ is exactly tangential to $V(p)$ at the latter. This linear line is the smallest concave function lying weakly above $V(p)$, which we refer to as the concavification of $V(p)$. The expected utility given belief cutoffs $(0, \bar{p}^{tr})$ is given by the intersection of the concavification and the vertical line above p_0.

Theorem 3 shows that when the interior solution $\tilde{p}$ exists, it must be the optimal upper cutoff $\bar{p}^{tr}$ and it must be smaller than l, i.e. $\bar{p}^{tr} = \tilde{p} < l$.[19] Since $\bar{p}^{co} \geq l$, for this class of types, $\bar{p}^{tr} < \bar{p}^{co}$.

Theorem 3 *When $r > 0$, for any type u with $u'(1) < r$, let $\tilde{p}$ be the interior solution of (11). When $p_0 \geq \tilde{p}$, the agent acquires no information; When $p_0 < \tilde{p}$, $\underline{p}^{tr} = 0$ and $\bar{p}^{tr} = \tilde{p} < l$.*

The proof of Theorem 3 is in the Appendix.

In summary, we have shown that, just like Theorem 1 states, (i) the lower cutoff $\underline{p}^{tr}$ is always weakly smaller than $\underline{p}^{co}$, since it is always 0; (ii) the upper cutoff $\bar{p}^{tr}$ is always weakly smaller than $\bar{p}^c$. Specifically, when the upper cutoff $\bar{p}^{tr}$ is equal to 1, $\bar{p}^{co}$ also must be 1; when the upper cutoff $\bar{p}^{tr}$ is smaller than 1, it must be strictly smaller than $\bar{p}^{co}$.

3.3 Belief Cutoffs in the Experiment

In this section, we infer the belief cutoffs using the experimental data and compare them between treatments.

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[19]In the Appendix we show that an interior solution of (11) exists when $u'(1) < r$, i.e. whenever, the agent does not acquire full information.

We find that the large majority of subjects behave consistently with the model (431 out of 496; *Control*: 228 out of 246; *Tradeoff*: 203 out of 250), i.e. they choose x if they stop at a posterior weakly above the prior or y if they stop at a posterior weakly below the prior.[20] For dictators who stop acquiring information at the equivalent of their prior belief of 0.35, 0.35 is interpreted as their upper cutoffs if they choose x and as their lower cutoffs if they choose y.

Table 7 summarizes the fraction of dictators who stop at their upper belief cutoffs $\bar{p}$. It reveals that the distribution of posterior belief cutoffs differ between *Tradeoff* and *Control.* In *Tradeoff*, 49% dictators stop acquiring information at a posterior beliefs above the prior belief, while in *Control* the fraction is only 31% (Chi square, $p = 0.00$). This finding is consistent with our theoretical model.

Figure 6 shows the empirical cumulative distribution function of the upper and lower belief cutoff. Both the lower and the upper cutoff are *lower* in the Tradeoff treatment, consistent with Theorem 1. [21]

Table 7: Proportion of Dictators Reaching the Upper Belief Cutoff $\bar{p}$

	Overall	*Tradeoff*	*Control*	Chi-2 p
Stop at $\bar{p}$	39%	49%	31%	0.00

[20]In the *Control* treatment, 14 dictators choose y after having received more good news, 4 dictator choose x after having received more bad news. In the *Tradeoff* treatment, 10 dictators choose y after having received more good news, 37 subjects choose x after having received more bad news.

[21]For the interpretation of the right tail of the distributions, note that only 5% dictators stop at beliefs higher than 0.80, such that the estimation of the cumulative distribution functions at very high beliefs is driven by only very few observations.

Figure 6: Distribution of the Observed Belief Cutoffs

(a) CDf of the lower belief cutoff

(b) CDF of the upper belief cutoff
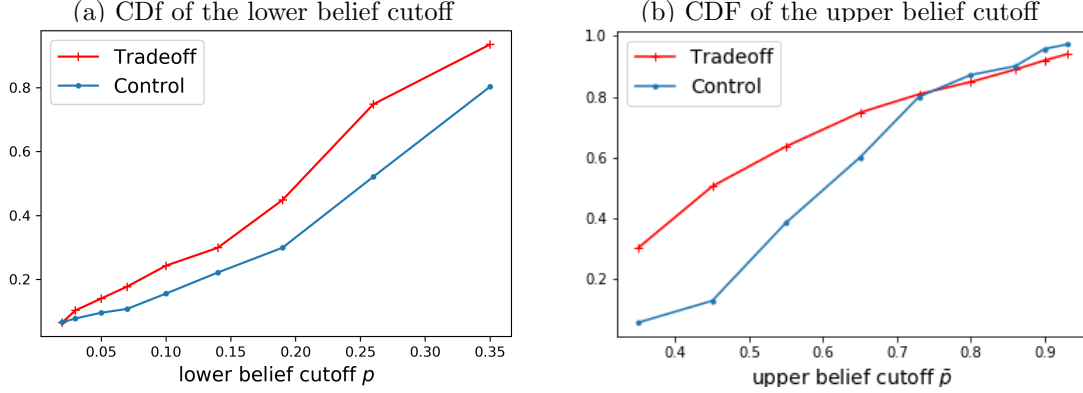
These figures show the empirical cumulative distribution functions of the upper belief cutoff (Figure 6b) and the lower belief cutoff (Figure 6a). The CDF of the lower belief cutoff reflects the data of all individuals who stop information acquisition at posterior beliefs weakly below the prior and choose y. The CDF of the upper belief cutoff reflects individuals who stop weakly above the prior and choose x.

4   Receiver Welfare

Do the dictators in *Tradeoff*, for whom x is self-rewarding, more often choose the option that reduces the receivers' payment, than the dictators in *Control*? This might seem to be the case, since the dictators in treatment *Tradeoff* might biases towards choosing x, whereas the dictators in *Control* are impartial between the option x and y. Indeed, our data show that in both states the dictators in *Tradeoff* are more likely to choose x than dictators in *Control* (details see Section 4.2). However, we find that, despite the higher tendency to choose x, the dictators in *Tradeoff* do *not* choose the option that reduces the receivers' payments significantly more often (*Tradeoff*: 32%; *Control*: 27%; Chi-2 $p = 0.17$). These two observations seem to contradict each other. What is the missing piece of the puzzle?

An option's being remunerative does not only directly affect the agent's decision between the options (*the decision effect*), but also indirectly affect her choice by affecting how she acquire information (*the information effect*). In Section 4.1, we

36

show theoretically that while the decision effect of the remuneration is always negative on the welfare of the other, the information effect is positive for some agent types. This information effect can sometimes offset the decision effect and leads to an overall neutral or even positive effect of the remuneration on the welfare of the other.

This counter-intuitive result arises from a moral hazard problem: when impartial between options, the agent might acquire little information. Therefore she sometimes mistakenly chooses the harmful option because she is ill-informed about the state. We show that one option's being remunerative can mitigate this moral hazard problem. Although she now more often falsely chooses x, the agent *less* often falsely chooses y because she now requires higher certainty in the innocuousness of y before choosing it.

In Section 4.2, we take the theory to our data. We disentangle the decision and the information effect in our experimental data. We find that in our experiment the information effect indeed improves receiver welfare and it offsets the negative decision effect resulting in no overall significant difference between treatments regarding the proportion of receivers whose payments were reduced by the dictators decisions.

4.1 Disentangle the Decision Effect and Information Effect in Theory

This section theoretically analyzes the effect of a remuneration $\bar{r} > 0$ for option x on the welfare of the passive person affected by the agent's decision between x and y. We call the passive person 'the other'.

First, let us formally express the expected utility of the other. Let $v(a, \omega)$ be the utility of the other when the agent chooses $a \in \{x, y\}$ in $\omega \in \{X, Y\}$. Recall that the other has negative utility of -1 if the chosen option does not match the state and has utility 0 otherwise, i.e. $v(x, Y) = v(y, X) = -1$ and $v(x, X) = v(y, Y) = 0$.

For any given belief, the agent chooses the option $a \in \{x, y\}$ that maximizes her own utility $U(a, p; r)$ (see (5)). Hence for given r, we write the chosen option as a function of her belief p, i.e. $a_r(p) = \max_{a \in [x,y]} U(a, p; r)$. We call a_r the *decision*

rule given r. τ pins down the joint distribution of the posterior belief realization and the state ω, given the prior belief p_0 and the Bayes-plausibility constrain. We hence can write the expected utility of the other given posterior belief distribution τ as

$$E_\tau v \equiv Ev(a_r(p), \omega)|\tau. \tag{12}$$

Notice in (12) that the agent determines the expected utility of the other by making two decisions: first, she chooses the decision rule $a_r(p)$; second, she chooses the information acquisition strategy and hence the posterior belief distribution τ. A remuneration for choosing x, i.e. $\bar{r} > 0$, affects both decisions. We call the effect of $\bar{r}$ on $E_\tau v$ through changing the decision rule $a_r(p)$ the *decision effect*; and we call the one through changing the posterior belief distribution τ the *information effect.*

We write the overall effect of the remuneration $\bar{r}$ on the expected utility of the other as

$$Ev(a_{tr}(p), \omega)|\tau^{tr} - Ev(a_{co}(p), \omega)|\tau^{co}, \tag{13}$$

where τ^{tr} is the optimal information acquisition strategy given $\bar{r} > 0$ and τ^{co} the optimal strategy given $r = 0$; a^{tr} is the decision rule when $\bar{r} > 0$ and a^{co} the decision rule given $r = 0$.

Next, we discuss the decision effect and the information effect of $\bar{r}$ on the expected utility $Ev(a_r(p), \omega)|\tau$ respectively.

The Decision Effect. We first discuss the decision effect, i.e. the effect of $\bar{r} > 0$ on the expected utility of the other through affecting the agent's choice between x and y given posterior beliefs. This effect can be expressed by the difference of expected utility of the other when keeping the posterior belief distribution fixed at τ^c and change the decision rule:

$$\mathrm{DE} \equiv Ev(\mathbf{a_{tr}}(p), \omega)|\tau^{co} - Ev(\mathbf{a_c}(p), \omega)|\tau^{co} \tag{14}$$

For any belief p, the agent chooses x over y iff

$$u(p) + r > u(1-p). \tag{15}$$

When there is no remuneration, i.e. $r = 0$, for any belief the agent always chooses the option that is less likely to be harmless for the other. She is indifferent between the two options at belief $p = 0.5$. However when x is remunerative, i.e. $\bar{r} > 0$, the agent's indifferent point is decreased, she chooses x for less certainty that it is harmless. Theorem 4 shows that this change of decision rule makes the other weakly worse off. The proof is in the Appendix.

Theorem 4 *For any $\bar{r} > 0$, any agent type $u(.)$,*

$$Ev(\mathbf{a_{tr}}(p), \omega)|\tau^{co} \leq Ev(\mathbf{a_{co}}(p), \omega)|\tau^{co},$$

i.e. the decision effect is weakly negative.

The Information Effect Next we discuss the effect of remuneration $\bar{r} > 0$ on the expected utility of the other that is due to change of the agent's optimal information acquisition strategy τ, i.e. the information effect. This effect can be expressed by keeping fixed the decision rule that is optimal given $\bar{r} > 0$ and changing the information acquisition strategy from τ^{co} to τ^{tr}:

$$\text{IE} \equiv Ev(a_{tr}(p), \omega)|\tau^{\mathbf{tr}} - Ev(a_{tr}(p), \omega)|\tau^{\mathbf{co}}. \tag{16}$$

Recall that Theorem 2 shows that when $r = 0$ an agent whose moral standard $l < 1$ has optimal information acquisition strategy that does not yield perfect beliefs, i.e. cutoffs other than 0 and 1 can be optimal for the agent. This implies that when $r = 0$, if the agent is satisfied before her belief reaches certainty, a *true* moral hazard problem arises: the agent only acquires partial information about the state. Consequently, she sometimes mistakenly choose x when the state is actually Y; and she also sometimes mistakenly chooses y when the state is actually X.

Theorem 5 shows that a self-reward of an option can serve as a motivation

device and mitigate the moral hazard problem. The intuition is that when x is remunerative, she makes no mistakes when she chooses option y – she only chooses y when she is certain that it is the option harmless to the other. The information effect therefore can be positive. We also show that, the positive information effect can dominate the decision effect and result in a overall positive effect of $\bar{r} > 0$ on the expected utility of the other.

Theorem 5 *There are agent types u such that the presence of a remuneration $\bar{r} > 0$ has a positive information effect on the expected utility of the other and the overall effect of $\bar{r} > 0$ on the expected utility of the other is positive.*

The proof is in the Appendix. Note that the overall effect is

$$\text{DE} + \text{IE} = Ev(a_{tr}(p), \omega)|\tau^{\mathbf{tr}} - Ev(a_{co}(p), \omega)|\tau^{\mathbf{co}},$$

namely, the difference of the other's expected utility between $\bar{r} > 0$ and $r = 0$.

4.2   The Receiver Welfare in the Experiment

In this section, we discuss the receiver welfare in our laboratory experiment. A direct between-treatment comparison of the receiver welfare confounds two effects of the self-reward on the receiver welfare: first, it directly affects their decision between x and y, given any acquired information (decision effect); second, the self-reward affects dictators' information acquisition, which in turn affects their beliefs about the unknown state and their choices between the options (information effect). Before we disentangle the decision effect and the information effect, we first present the dictators choice of x and y given realized posterior beliefs at their decisions.

We observe in our data that fixing the posterior belief, the dictators in *Tradeoff* decide differently between x and y than the dictators in *Control*. This difference affects the proportion of receivers whose incomes are reduced by the dictators' decisions (the decision effect). Specifically, in both treatments most dictators who have received more good news than bad news choose option x (*Tradeoff*: 91%, *Control*:

93%, chi-2 $p = 0.63$). Difference arises among those who have received more bad news than good news – a significantly higher fraction of these dictators in *Tradeoff* choose option x (*Tradeoff*: 27%, *Control*: 3%, chi-2 $p = 0.00$). Similarly, among those who have received equal number of good and bad news (final belief on x being harmless = 0.35), including those who acquire no information, significantly more dictators in treatment *Tradeoff* choose x than those in the *Control* treatment (*Tradeoff*: 81%, *Control*: 11%, chi-2 $p = 0.00$).

To empirically disentangle the decision effect and the information effect of the remuneration on the receivers' welfare, we construct a *Counterfactual* scenario, in which dictators acquire information as in the *Control* treatment, but decide as in the *Tradeoff* treatment given the acquired information and the final posterior beliefs (as illustrated in Table 8). When comparing the receiver welfare in the *Counterfactual* to the *Control* treatment, we isolate the decision effect, by keeping fixed the information acquisition behavior; when comparing the receiver welfare in the *Counterfactual* to that in the *Tradeoff* treatment, we isolate the information effect, by keeping fixed the decision between x and y given beliefs.

Table 8: *Counterfactual* Scenario

	Control	Tradeoff
posterior beliefs	×	
decision given belief		×
compared to the C'factual	*decision effect*	*information effect*

Table 9a and 9b show the decision effect and the information effect respectively. In Table 9a, we comparing the *Counterfactual* with the *Control* and find a negative decision effect. The dictators in the *Counterfactual*, who employs the decision rules in *Tradeoff* given any posterior belief, choose x more often in both states. Overall, in the *Counterfactual*, the proportion of unharmed receivers is lower than in the *Control* treatment (62% compared to 73%). This means that the decision effect

iss negative: option x' being self-rewarding for the dictators leads to a change of decision rule that makes the receivers worse-off.

In Table 9b, we compare *Tradeoff* with the *Counterfactual* and find a positive information effect. The remuneration makes a higher fraction of dictators to choose x when x is harmless (81% compared to 75%), and a higher fraction of dictators to choose y when y is harmless (60% compared to 54%). Overall, in *Tradeoff*, the proportion of unharmed receivers is higher than in the *Counterfactual* (68% compared to 62%). The information effect of remuneration on the receiver welfare is hence positive: option x being self-rewarding makes the dictators acquire information strategically, and in turn improves the receiver welfare.

As discuss before, there is a moral hazard problem when no option is remunerative – the dictators do not fully learn the state before they make a decision and hence often mistakenly choose the harmful option for the receiver. Note that in both states the proportions of dictators who choose the harmless option for the receiver are lower in the *Counterfactual* than in *Tradeoff*. This difference can only be due to different information acquisition behavior, since the decision rule is the same between the *Counterfactual* and *Tradeoff*. In our experiment, in *Control* 36% dictators who are actually in the *Good* state stop acquiring information at a belief in the Good state lower than their prior. The additional payment that the dictators can obtain by choosing x mitigates this moral hazard problem: in treatment *Tradeoff*, the proportion of dictators in the Good state who stop acquiring information below the prior is a lower 26%.

Aggregating both effects, the proportion of the receivers spared from harm does not significantly differ between the *Tradeoff* and the *Control* (68% compared to 73%, Chi-2 $p = 0.17$). It is decreased from 73% (*Control*) to 62% (*Counterfactual*) by more selfish decision-making, i.e. the decision effect, and is increased from 62% (*Counterfactual*) to 68% (*Tradeoff*) by strategic information acquisition, i.e. the information effect.

Table 9: The Effects of Remuneration on Receiver Welfare

(a) The Decision Effect

State	Good	Bad	Overall
	(x harmless)	(y harmless)	
Counterfactual:			
% no harm	75%	54%	62%
(# total dictators)	(88)	(158)	(246)
Control:			
% no harm	54%	83%	73%
(# total dictators)	(88)	(158)	(246)
The decision effect:			-11%

(b) The Information Effect

State	Good state	Bad state	Overall
	(x harmless)	(y harmless)	
Tradeoff:			
% no harm	81%	60%	68%
(# total dictators)	(87)	(163)	(250)
Counterfactual:			
% no harm	75%	54%	62%
(# total dictators)	(88)	(158)	(246)
The decision effect:			6%

This table presents the decision effect and the information effect of the remuneration in our experiment. The *Counterfactual* is calculated by combining the posterior beliefs from the *Control* and the mapping from beliefs to choices in the dictator game from *Tradeoff*. Comparing the *Conterfactual* to the *Control* (*Tradeoff*), we obtain the decision effect (information effect).

5 Concluding Remarks

This paper experimentally and theoretically investigates how people acquire information about the externalities of their options before a decision.

We present experimental evidence that when faced with a self-benefiting option that might harm others, individuals acquire noisy information strategically: they tend to carry on acquiring information when they have received mostly information suggesting that behaving selfishly harms others; while they tend to stop, having received information indicating the opposite. In our experiment, individuals with higher intelligence exhibit a stronger tendency to acquire information this way, suggesting that this information acquisition behavior is more likely be due to strategic considerations than limited cognitive ability.

This empirical finding sheds light on how people acquire information in various contexts where decisions incur unknown consequences on others, and noisy information is available for inquiry. One example is in the credence goods market. The research on credence goods has been focusing on the deceptive behavior of the credence goods provider, while the psychology of them is less understood. The credence goods providers – physicians, car mechanics, taxi drivers – who care for the well-being of their customers face a dilemma between their monetary compensations and their unwillingness to harm their customers. Our finding suggests that credence goods providers might mitigate this dilemma by strategically learning about the best option for the customers. If by examining the need of a customer, they can persuade themselves that a profitable option is actually the one right for the customer, their dilemma is resolved.

Our findings also help to understand labor market discrimination. A discriminatory recruiter who likes to think of himself as nondiscriminatory might be able maintain this positive self-view while hiring in a biased manner, by selectively stopping interviewing the candidate to persuade himself that a candidate of his less preferred character is disqualified. This insight has implications on the quality distribution of successful labor market candidates across ethnic groups and gender.

In other contexts such as charitable giving and media consumption for voting,

our result highlights the importance of the first pieces of information sent and received. If the potential donors' first information about a charitable organization is negative, she might readily stop learning about the charity and decide to keep her money in her pocket. The charity will then have a hard time to raise for its cause. When a voter inquires about an ethical issue with personals cost for him (e.g. additional taxes), if the first new articles that he reads leans against it, the voter is likely to stop the inquiry and vote against it.

In terms of theory, we propose a tractable model that analyzes the acquisition of information with any degree of noise. The model applies techniques developed for studying interpersonal Bayesian persuasion (Kamenica and Gentzkow, 2011) to the investigation of information acquisition of a single Bayesian agent. It offers intuitive geometric tools that generate rich results. Our model also addresses an important yet little understood dimension of social decision making: other-regarding preferences under uncertainty. We suggest that other-regarding preferences can be modeled by a belief utility that is increasing in the probability with which the agent believes that her decision does not harm others. With this model approach, we are able to explain many empirical findings on the information choices in social decisions with uncertainty, including the noisy inforamtion acquisition strategy found in our own experimental and the avoidance of perfect information observed by Dana, Weber, and Kuang (2007) and Feiler (2014) (see Appendix B.1). We hope that it is a step towards a more comprehensive understanding of other-regarding preferences, and might facilitate modeling in related settings in the future.

Our finding that motivated information acquisition can improve the welfare of the other affected by the decision is particularly relevant for policy makers. Under the opposite intuition that strategic information acquisition motivated by selfish incentives must increase negative externalities, it might seem to be a good idea to debias the information acquisition behavior by involving an independent investigator whose compensation is not related to the decision. However, our model and our data suggest that sometimes such strategic information acquisition motivated by selfish incentives can make the other party affected by the decision *better-off*. This

finding offers the novel insight that assigning the job of collecting information to an independent investigator, who is disinterested in the decision, can sometimes lead to worse decision making and more negative externalities.

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Appendices

A   Empirical Appendices

A.1   Summarizing Statistics

Here we provide summarizing statistics on our data. The basic information of the subjects in each treatment is summarized in Table 10.

Table 10: Basic Information of Subjects

		no. obs.	Good State	women	student	av. age
Force	Tradeoff	82	.34	.45	.95	22
	Control	79	.37	.54	.95	22
	p value		.73	.24	.56	.50
NoForce	Tradeoff	168	.35	.66	.93	24
	Control	167	.35	.65	.92	24
	p value		.97	.79	.56	.36
Pooled	Tradeoff	250	.35	.59	.94	24
	Control	246	.36	.61	.93	24
	p value		.82	.62	.56	.25

This table presents the basic characteristics of our subjects in each treatment. The Mann-Whitney U test verifies that our randomization was successful.

A.2 Number of Balls Drawn and the Posterior Beliefs

Table 11 summarizes the dictators' information acquisition behavior.

Table 11: Information Acquisition Behavior

		no. balls (median)	av. belief at decision	% stop above prior
Force	Tradeoff	7.5	.30	.33
	Control	4	.36	.37
	p value	.04	.04	.67
NoForce	Tradeoff	5	.34	.37
	Control	6	.33	.33
	p value	.92	.76	.44
Pooled	Tradeoff	6	.35	.36
	Control	5	.36	.34
	p value	.24	.82	.71

This table presents the statistics of the dictators' information acquisition behavior and the Mann-Whitney-U test p values comparing between *Tradeoff* and *Control* respectively. In the *NoForce* treatments, only dictators who draw at least one ball are included.

A.3   Dictator Game Decision

Table 12 summarizes the dictator game decisions.

Table 12: Dictator Game Decisions

		Choosing x%			Harm %
		Good	Bad	Overall	
Force	Tradeoff	.71	.43	.54	.38
	Control	.62	.14	.32	.23
	p value	.46	.00	.01	.04
NoForce	Tradeoff	.86	.38	.55	.30
	Control	.51	.18	.29	.29
	p value	..00	.00	.00	.84
Pooled	Tradeoff	.81	.40	.54	.32
	Control	.54	.16	.30	.27
	p value	.00	.00	.00	.17

The first three columns of this table presents the proportions of dictators who choose x given *Good* and *Bad* states and the treatments, together with the Mann-Whitney U test p values comparing between *Tradeoff* and *Control* respectively. In the *Good* state, x does not harm the receiver, while in the *Bad* state it does. The last column presents the percentage of dictators whose decision reduced the receivers' payoffs in the dictator game.

A.4 Robustness Check: The Logistic Regression

Using the data at the person-draw level, we estimate the following logistic model as a robustness check and find result similar to that in Section: 2.2.2 .

$$logit\, h(X) = X \cdot b + Z \cdot a + (C + T \cdot c) + \epsilon i, \qquad (17)$$

where $h(X)$ is the hazard that the dictator stops acquiring information after that draw; X denotes the same covariates of interest as in the Cox model, i.e.

$$X \cdot b = \beta_1 \text{Tradeoff} + \beta_2 \text{Info} + \beta_{12} \text{Tradeoff} \times \text{Info}.$$

The control valuables in Z include gender, cognitive ability, prosociality and belief accuracy, all measured in the same way as in the Cox model in Section 2.2.2. T is a vector of time dummies, which captures the time dependency of the probability to stop acquiring information.

When interpreting the results, this logistic model can be viewed as a hazard model in which the covariates proportionally affect the *odds* of stopping acquiring information (Cox, 1975). Formally,

$$\frac{h(t)}{1 - h(t)} = \frac{h_0(t)}{1 - h_0(t)} \cdot exp(X_t \cdot b + Z_t \cdot a)$$

$$\Rightarrow \underbrace{log\left(\frac{h(t)}{1 - h(t)}\right)}_{logit\, h(X)} = \underbrace{log\left(\frac{h_0(t)}{1 - h_0(t)}\right)}_{C + T \cdot c} + X_t \cdot b + Z_t \cdot a. \qquad (18)$$

Unlike in the framework of the Cox model, the coefficients here cannot be interpreted as hazard ratios. Instead, they should be interpreted as odds ratios. Our prediction that the hazard to stop acquiring information is lower in *Tradeoff* when bad news dominates suggests a negative β_1. And the prediction that the hazard is higher when good news dominates suggest a positive $\beta_1 + \beta_{12,Good}$. Results reported in Table 13 support these predictions.

Table 13: The Logistic Model Results

		Pooling All		Force	NoForce
$\hat{\beta}_1$	treatment *Tradeoff*	-.25*	-.26*	-.56**	-.18
		(.15)	(.15)	(.25)	(.18)
$\hat{\beta}_{12}$	Tradeoff ×				
	Good news dominance	.35*	.37*	.71**	.34
		(.22)	(.22)	(.37)	(.26)
	Balanced	-.54	-.53	-.62	-.40
		(.40)	(.41)	(.73)	(.49)
$\hat{\beta}_2$	Good news dominance	-.21	-.21	-.14	-.26
		(.18)	(.18)	(.29)	(.24)
	Balanced	-.67**	-.68**	-.46	-78**
		(.28)	(.28)	(.46)	(.35)
Control Variables:					
Belief Accuracy		Yes	Yes	Yes	Yes
Gender, IQ, Prosociality		Yes	Yes	Yes	Yes
Time Dummies		Yes	Yes	Yes	Yes
Force Treatment Dummy		No	Yes	–	–
Observations (person-draws)		4,658	4,658	1,567	2,932
Pseudo R2		.07	.07	.09	.07

This table presents the estimated *coefficients* of the logistic model, with standard errors clustered at the individual level. *, **, and *** denote significance at the 10, 5 and 1 percent level. The dependent variable is the hazard to stop acquiring information, and the key coefficients of interests are $\hat{\beta}_1$ and $\hat{\beta}_{12}$. $\exp(\hat{\beta}_1)$ reflects the treatment effect on the dictators' odds to stop acquiring further information, given information histories dominated by bad news. And $\exp(\hat{\beta}_1 + \hat{\beta}_{12}|\text{Good news dominance})$ reflects the treatment effect on the odds, given information histories dominated by good news. We control for belief accuracy, gender, the prosocial types (categorised by the SVO test) and the cognitive ability (measured by in the Raven's matrices test). The time dependency of the odds is accounted for by including a dummy for each time period.

A.5   Complementary Stage

After the experiment, we elicited the dictators' posterior beliefs on the state and their SVO scores. We also asked them to answer a questionnaire, consisting of questions on their sociodemographics, self-reported risk preferences, time preferences, preferences for fairness, reciprocity. A selective subset of the HEXACO personality inventory (Ashton and Lee, 2009) and 5 items from Raven's progressive matrices intelligence test are also included.

Elicited Beliefs   In the experiment, we display the Bayesian posterior belief on the state after each draw of information on the screens of the dictators. After the dictators stop acquiring information, we elicit subjects' beliefs on the state, given all the information acquired. Figure 7 plots the histogram of the difference between the Bayesian posterior beliefs and the elicited posterior beliefs at the end of the information acquisition. The majority of subjects' elicited beliefs coincide with the Bayesian posterior beliefs after the last ball they draw (299 out of 496), the elicited beliefs of the self-rewarding option x being harmless is higher than the Bayesian posterior beliefs by 2.60% (one-sample t-test $p = 0.00$). Figure 7 reveals no systematic bias in the elicited beliefs.

SVO Scores   The average SVO score of all the subjects is 20.49, with no significant difference between *Tradeoff* and *Control* treatments (Mann-Whitney-U test, $p = 0.84$). According to Murphy, Ackermann, and Handgraaf (2011), 48% subjects are categorized as 'prosocials', 15% 'individualists' and 37% 'competitive type'.

Cognitive Abilities   On average the subjects answered 3.60 out of 5 questions in the Raven's matrices test correctly. There is no significant difference between *Control* and *Tradeoff* treatments (Chi square $p = 0.12$). When asked about a simple question on probability, in both treatments 92% subjects answer correctly (Mann-Whitney-U test $p = 0.85$).[22]

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[22]We use the following question to elicit subjects' understanding of probabilities:
Imagine the following 4 bags with 100 fruits in each. One fruit will be randomly taken out. For

Figure 7: Difference between elicited posterior beliefs and Bayesian posterior beliefs
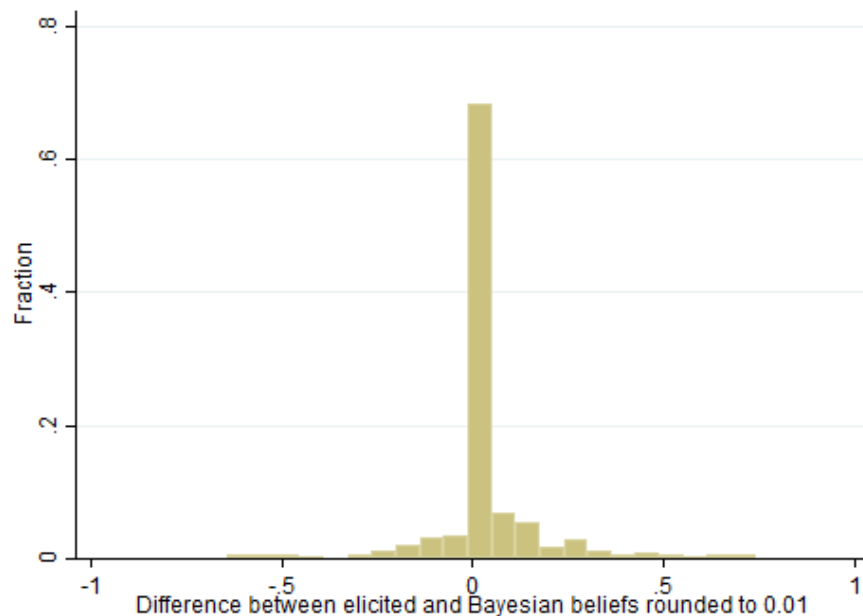
Preferences To elicit risk preferences, time preferences, preferences for fairness and reciprocity, we use survey questions in Falk et al. (2016). We report the exact questions in Table 14. All answers are given on a 0 to 10 scale.

HEXACO-60 proposed by Ashton and Lee (2009) is a personality inventory that assesses the following six personality dimensions: Honesty-Humility (HH), Emotionality (EM), Extraversion (EX), Agreeableness (AG), Conscientiousness (CO), and Openness to Experiences (OP). We select 4 questions with the highest factor loading in each dimension (as reported in Moshagen, Hilbig, and Zettler, 2014) and in addition, include 4 questions from the Altruism versus Antagonism scale (AA) proposed in Lee and Ashton (2006). Table 15 reports the exact questions we ask. All questions are answered on a scale from 1 to 5, where 5 means strongly agree and 1 means strongly disagree. We use the German self-report form provided by

which bag, the probability of taking a banana is 40%?
A. A bag with 20 bananas.
B. A bag with 40 bananas.
C. A bag with 0 banana.
D. A bag with 100 bananas.
The correct answer is B.

hexaco.org.

Table 14: Preferences Elicitation in the Questionnaire

Preferences for	Question
Risk	Please tell me, in general, how willing or unwilling you are to take risks. (10 means very willing, 0 means completely unwilling)
Time	How willing are you to give up something that is beneficial for your today in order to benefit more from that in the future? (10 means very willing, 0 means completely unwilling)
Altruism	I am always ready to help others, without expecting anything in return.
Fairness	Q1: I think, it is very important to be fair. Q2: I, in general, agree that unfair behaviors should be punished.
Positive reciprocity	I am always ready to go out of my way to return a favor.
Negative reciprocity	I am always ready to take revenge if I have been treated unfairly.

Table 15: Selected Items From the HEXACO Personality Inventory

Dimension	Question
HH	12. If I knew that I could never get caught, I would be willing to steal a million dollars.
	18. Having a lot of money is not especially important to me.
	42. I would get a lot of pleasure from owning expensive luxury goods.
	60. Id be tempted to use counterfeit money if I were sure I could get away with it.
EM	17. When I suffer from a painful experience, I need someone to make me feel comfortable.
	41. I can handle difficult situations without needing emotional support from anyone else.
	47. I feel strong emotions when someone close to me is going away for a long time.
	59. I remain unemotional even in situations where most people get very sentimental
EX	10. I rarely express my opinions in group meetings.
	22. On most days, I feel cheerful and optimistic.
	28. I feel that I am an unpopular person.
	40. The first thing that I always do in a new place is to make friends.
AG	3. I rarely hold a grudge, even against people who have badly wronged me.
	15. People sometimes tell me that I'm too stubborn.
	21. People think of me as someone who has a quick temper.
	45. Most people tend to get angry more quickly than I do.
CO	2. I plan ahead and organize things, to avoid scrambling at the last minute.
	26. When working, I sometimes have difficulties due to being disorganized.
	44. I make a lot of mistakes because I dont think before I act.
	56. I prefer to do whatever comes to mind, rather than stick to a plan.
OP	1. I would be quite bored by a visit to an art gallery.
	13. I would enjoy creating a work of art, such as a novel, a song, or a painting.
	25. If I had the opportunity, I would like to attend a classical music concert.
	55. I find it boring to discuss philosophy.
AA	97. I have sympathy for people who are less fortunate than I am.
	98. I try to give generously to those in need.
	99. It wouldnt bother me to harm someone I didnt like.
	100. People see me as a hard-hearted person.

B Theory Appendices

B.1 Additional Theoretical Results

In this section, we discuss two additional results of our model and the respective empirical evidences: the avoidance of noisy and perfect information. While our experiment focuses on *noisy* information, the information that can be analyzed in our model encompasses both noisy and *perfect* information, i.e. information that reveals the truth in one piece.

Our model predicts that with or without a remunerative option, there are agents who acquire no noisy information at all (Section B.1.1). In line with this prediction, in both treatments in our experiment there are dictators who do not acquire any noisy information before making the dictator decision.

Regarding perfect information, our model predicts that there are agents who avoid *perfectly revealing* information. This result is consistent with the empirical finding of Dana, Weber, and Kuang (2007). In addition, we theoretically show that the higher is the prior belief that the self-rewarding option is harmless to others, the more agent types would avoid perfect information. This prediction is in line with the experimental finding of Feiler (2014).

B.1.1 Avoidance of Noisy Information

Our model predicts that both in decisions with or without a remunerative option, there are some agent types who move on to the decision without acquiring any noisy information (Theorem 6).

Theorem 6   *1. When $r = 0$, for any prior $p_0 \in (0,1)$, there is a set $S^{co}(p_0)$ of preference types u that avoid information completely, i.e. the belief cutoffs $\underline{p}^{co} = \overline{p}^{co} = p_0$ are optimal.*

    2. When $r > 0$, for any prior $p_0 \in (0,1)$, there is a set $S^{tr}(p_0)$ of preference types u that avoid information completely, i.e. the belief cutoffs $\underline{p}^{tr} = \overline{p}^{tr} = p_0$ are optimal.

In the experiment, we find that 15% and 7% dictators do not acquire any noisy information in the *Tradeoff–NoForce* and the *NoForce –Control* treatment respectively (Chi-2 $p = 0.00$). In the *Tradeoff–NoForce* treatment, among those who avoid noisy information completely 96% choose the remunerative action x (25/26). In contrast, in the *Control–Force* treatment, only 17% of those who avoid noisy information choose x (2/12).

In theory, the types of agent who acquire no information, when no option is remunerative, are those with moral standard $l \leq p_0$ or $l \leq 1 - p_0$, i.e. those for whom there is already no gain in belief utility for more certain beliefs at the prior belief. Recall that the dictators' prior belief in our experiment is fixed at 35% in x's innocuousness. The observation that in the *Control* treatment, most dictators completely who avoid noisy information choose option y suggests that these are the dictators with moral standards $l \leq 65\%$. They are satisfied with 65% certainty that y is the harmless option, and more certainty does not bring them any additional utility.

In the decision with remuneration, the agent decides not to acquire noisy information only if at the prior belief she would choose x. Information then poses an undesirable risk that the information acquired might reverse her decision from x to y. She avoids noisy information only when this risk outweighs her utility gain from more certain beliefs that she does not harm the other. This intuition is consistent with the observation that all except for one dictator who avoid noisy information completely in the *Tradeoff–NoForce* treatment choose option x.

B.1.2   Avoidance of Perfect Information

While our experimental investigation focuses on the acquisition of noisy information that unravels the unknown state piece by piece, our model also makes predictions about how people acquire information that reveals the truth at once – *perfectly revealing information.*

Recall that in our theoretical model, the agent can choose any signal structure (Section 3.1). Perfectly revealing information is a special case of the signal struc-

tures that the model encompasses. Let $p_0 \in (0,1)$ be any uncertain prior belief. The decision whether or not to acquire a piece of perfectly revealing information, is formally the preference between the posterior belief distribution τ^{p_0} that has mass 1 on the prior belief p_0 and the posterior distribution τ^{ce} with $supp(\tau^{ce}) = \{0,1\}$. Theorem 7 shows that in the presence of a remuneration, for any uncertain prior belief there are types of dictators who would avoid perfectly revealing information. The higher is the prior belief in the alignment between the dictator's and the receiver's payment, the more types of dictators would avoid perfect information.

Theorem 7   *1. When $r > 0$, for any prior $p_0 \in (0,1)$, there is a set $S(p_0)$ of preference types u that avoid perfectly revealing information, i.e. $\tau^{p_0} \succ \tau^{ce}$.*

    2. For any prior beliefs $p_0^l < p_0^h \in (0,1)$, it holds that $S(p_0^l) \subset S(p_0^h)$.

A piece of perfectly revealing information either makes the agent certain that the remunerative option is harmless, or makes her certain that it is harmful. For an agent who would choose the remunerative option at the prior belief, if the realized signal is that the remunerative option is harmless, the agent gains in belief utility, as she becomes more certain that she is not harming the other. But on the other hand, she faces the risk that the realized signal would make her certain that the remunerative option is harmful, so that she would have to forgo the remuneration and choose the other option instead.

The first item of Theorem 7 shows that for any uncertain prior belief, there are some types of agents for whom the risk of having to forgo the remuneration outweighs the potential gain in belief utility, so that they would rather avoid the perfect information and make a decision based on their prior beliefs. Trivially, agent types with weakly convex preference type u will always acquire perfect information. These agents who avoid perfect information must have strictly concave belief utility u.

The second item of Theorem 7 predicts that when the prior belief is higher, it is optimal for more agent types to avoid the perfect information and choose the remunerative option directly. When the prior belief increases, on the one hand, the

additional belief utility from being certain that the preferred option is indeed harmless decreases, so the perfect information becomes less attractive; but on the other hand, the probability that the remunerative option is actually harmless increases, so the perfect information becomes more attractive. Since these agent types who avoid perfect information have strictly concave belief utilities u, the magnitude of the first negative effect becomes larger with increasing prior, while the magnitude of the second positive effect is linear in the prior belief. Therefore, as the prior increases, the perfect information becomes overall less attractive and more agent types would avoid perfect information.

These predictions are consistent with previous empirical findings. In a dictator environment similar to ours, Dana, Weber, and Kuang (2007) find that a significant fraction of dictators avoid information that reveals the *ex-ante* unknown state all at once. Feiler (2014) further documents that the fraction of dictators who avoid such perfectly revealing information increases with the dictators' prior belief that a self-benefiting option has no negative externality.

B.2 Proofs

B.2.1 Proof of Lemma 1 and Theorem 2

Proof of Lemma 1. The statement holds trivially when u is strictly convex since then the agent strictly prefers Black-well more informative information and the unique optional posterior distribution has support on $\underline{p} = 0$ and $\overline{p} = 1$. It remains to prove the lemma when u is weakly concave. Consider any optimal posterior distribution τ. Suppose that there are two beliefs $p_1, p_2 \geq p_0$ with $\Pr_\tau(p_1) > 0, \Pr_\tau(p_2) > 0$. Let $\hat{p} = \Pr_\tau(p_1) + \Pr_\tau(p_2)p_2$. Then $\hat{p} \geq p_0$. Also,

$$V(\hat{p}) - (\Pr_\tau(p_1)V(p_1) + \Pr_\tau(p_2)V(p_2)) = u(\hat{p}) - (\Pr_\tau(p_1)u(p_1) + \Pr_\tau(p_2)u(p_2)) \geq 0,$$

since u is weakly concave. So, we see that she is weakly better off with the posterior distribution that arises from τ when shifting the mass from p_1 and p_2 to $\hat{p}$. Suppose that there are two beliefs $p_1, p_2 \leq p_0$ with $\Pr_\tau(p_1) > 0, \Pr_\tau(p_2) > 0$. The analogous

65

argument shows that shifting mass from p_1 and p_2 to $\hat{p} = \Pr_\tau(p_1) + \Pr_\tau(p_2)p_2$ makes her weakly better off. This finishes the proof of the Lemma.

Proof of Theorem 2. When $r = 0$, any pair of beliefs $(\underline{p}^c, \overline{p}^c)$ with $\underline{p}^c \in [1 - l, l]^c$ and $\overline{p}^c \in [1 - l, l]^c$ implies an expected continuation value $\mathrm{E}_{(\underline{p}^c, \overline{p}^c)}V(p)$ of 0. Since, given $r = 0$, the expected continuation value for any posterior distribution τ is weakly negative, any such pair of belief cutoffs is optimal. This finishes the proof of Theorem 2.

B.2.2 Proof of Theorem 6, Theorem 1, and Theorem 3

Let $r > 0$. Any optimal pair of belief cutoffs $\underline{p} \leq \overline{p}$ satisfies Bayes-plausibility,

$$\overline{p}\Pr_\tau(\overline{p}) + \underline{p}(1 - \Pr_\tau(\underline{p})) = p_0, \tag{19}$$

which pins down how likely it is that she stops at the upper cutoff $\overline{p}$ and how likely it is that she stops at the lower cutoff $\underline{p}$, given the prior belief. The likelihood of the upper belief cutoff is negatively proportional to its relative distance to the prior,

$$\Pr_\tau(\overline{p}) = \frac{p_0 - \underline{p}}{\overline{p} - \underline{p}}. \tag{20}$$

The expected continuation value, given belief cutoffs $(\underline{p}, \overline{p})$ is therefore

$$\mathrm{E}_{(\underline{p}, \overline{p})}V(p) = \frac{p_0 - \underline{p}}{\overline{p} - \underline{p}}V(\overline{p}) + \frac{\overline{p} - p_0}{\overline{p} - \underline{p}}V(\underline{p}), \tag{21}$$

which is simply the value of the affine function connecting $V(\overline{p})$ and $V(\underline{p})$ through the prior. Since $r > 0$, there is a unique pair of beliefs $(\underline{\tilde{p}}, \tilde{p})$ that support the concave envelope.[23] Note that

$$\underline{\tilde{p}} = 0. \tag{22}$$

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[23] The smallest concave function that lies weakly above V is called the concave envelope of V; compare to Figure 8.

The following lemma shows that the pair of belief cutoffs $(\underset{\sim}{p}, \tilde{p})$ is the unique optimal strategy whenever it is not optimal to acquire no information.

Lemma 2 *Let $r > 0$.*

1. *When $p_0 \in [\underset{\sim}{p}, \tilde{p})$, then there is a unique pair of optimal belief cutoffs, given by $(\underline{p}^{tr}, \overline{p}^{tr}) = (\underset{\sim}{p}, \tilde{p})$.*

2. *When $p_0 \notin [\underset{\sim}{p}, \tilde{p})$, then acquiring no information is optimal, i.e. the belief cutoffs $\underline{p}^{tr} = \overline{p}^{tr} = p_0$ are optimal.*

Proof. Consider any two belief cutoffs $\underline{p} \leq p_0 \leq \overline{p}$ and the value of the connecting function at the prior. The optimal belief cutoffs maximize (21).

The claim can be seen geometrically: when $p_0 \in [\underset{\sim}{p}, \tilde{p}]$, the optimal belief cutoffs are given by the unique pairs of beliefs $\underset{\sim}{p}$ and $\tilde{p}$ that support the concave envelope of V (see Figure 8a). Whenever $p_0 \notin [\underset{\sim}{p}, \tilde{p})$, the maximum of (21) is achieved through no information acquisition (see Figure 8b). ■

Proof of Theorem 6 The first item of Theorem 6 follows from Theorem 2 since, for any prior $p_0 \in (0, 1)$, there is an open set of preference types u for which $p_0 \in [l, 1-l]^c$.

Lemma 2 together with (22) implies that for $r > 0$, the optimal lower belief cutoff is $\underset{\sim}{p} = 0$. Therefore, it follows from Lemma 2 that, for any prior $p_0 \in (0, 1)$, the set $S(p_0)$ of types u for which no information acquisition is optimal is given by the types for which $p_0 \geq \tilde{p}$. This shows the second item of Theorem 6. Also note that this set is strictly smaller when the prior is larger.

Proof of Theorem 1 It remains to show the theorem for the case when u is weakly concave; see the discussion after Theorem 2. Take any weakly concave u, any optimal strategy $(\underline{p}^c, \overline{p}^c)$ given $r = 0$. Suppose that it is not optimal to acquire no information given $\bar{r} < 0$.

Figure 8: Optimal Belief Cutoffs

(a) Complete Information Avoidance

(b) Optimal Belief Cutoffs Other Than the Prior
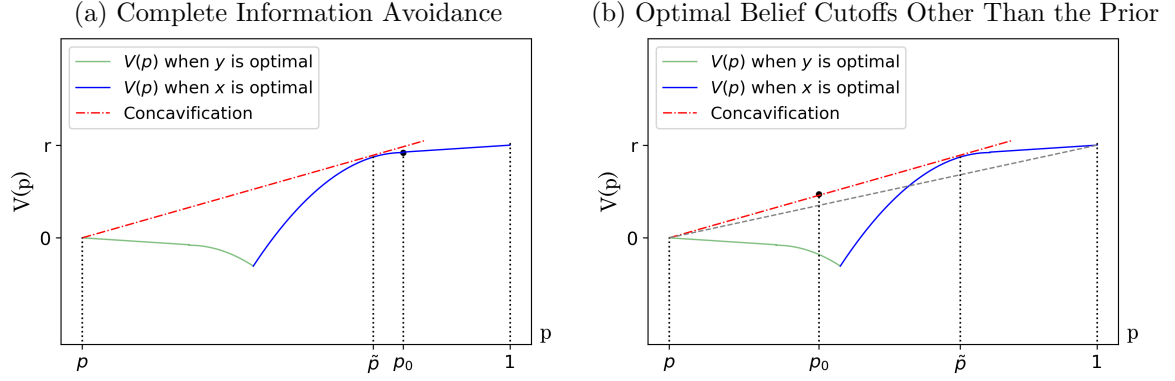
Note: The green and the blue line show the continuation value function V which is defined component-wise. The beliefs $\underset{\sim}{p}$ and $\tilde{p}$ are the unique beliefs supporting the concave envelope of V. The agent cannot improve on the belief cutoffs $(\underset{\sim}{p}, \tilde{p})$ when $p_0 \in [\underset{\sim}{p}, \tilde{p}]$: This can be seen geometrically: given (21), the optimal cutoffs maximize the value of the connecting function at the prior. Any other choice implies that the connecting line (grey) takes a value at the prior lower than $V(p_0)$ (left) or lower than the line connecting $\underset{\sim}{p}$ and $\tilde{p}$ (right). When $p_0 \notin [\underset{\sim}{p}, \tilde{p}]$, it is optimal for the agent to acquire no information.

Given Lemma 2, there are unique optimal belief cutoffs $\underline{p}^{tr} < p_0 < \bar{p}^{tr}$, and, given (22), it holds $\underline{p}^{tr} = 0$. Given (21), the upper belief cutoff $\bar{p}^{tr}$ maximizes

$$\max_{p \in [p_0, 1]} \Pr(p) V(p; \bar{r}) \tag{23}$$

subject to the Bayes-plausibility constraint that $\Pr(p)p = p_0$. Plugging in the Bayes-plausibility constraint gives the objective function

$$\max_{p \in [p_0, 1]} \frac{p}{p_0} V(p; \bar{r}), \tag{24}$$

and taking derivatives gives the first-order condition

$$\frac{p_0}{p} u'(p) - \frac{p_0}{p^2} V(p; \bar{r}) = 0$$
$$\Leftrightarrow \quad p u'(p) - V(p; \bar{r}) = 0. \tag{25}$$

The maximization problem (23) has a solution since continuous functions take maxima on compact sets. Note that the second derivative of the objective function (24)

68

is weakly negative,

$$\frac{\partial}{\partial p}(pu'(p) - u(p) - \bar{r}) = pu''(p) \leq 0, \tag{26}$$

where we used that u is weakly concave.

Case 1 $u'(1) \geq \bar{r} > 0$

The condition $u'(1) \geq \bar{r}$ implies that $l = 1$. Therefore, without remuneration, $r = 0$, the optimal belief cutoffs are $(\underline{p}^c, \bar{p}^c) = (0, 1)$. Since $\underline{p}^{tr} = 0$, the inequalities (8) and (9) follow. This finishes the proof of the theorem for Case 1.

Case 2 $u'(1) < \bar{r}$

The condition $u'(1) < \bar{r}$ is equivalent to

$$1u'(1) - V(1) < 0. \tag{27}$$

If $l < 1$, then $u'(p) = 0$ for $p \geq l$ since u is continuously differentiable. In any case,

$$lu'(l) - V(l) < 0. \tag{28}$$

Suppose that the derivative of the objective function is weakly negative for all $p \in [p_0, 1]$; this is equivalent to

$$p_0 u'(p_0) - V(p_0; \bar{r}) \leq 0, \tag{29}$$

given (26). Then, the objective function is maximized at the boundary $\bar{p} = p_0$. Bayes-plausibility implies that $\Pr(\bar{p}) = 1$. We conclude, that no information acquisition is optimal. However, we excluded this case by assumption. Therefore,

$$p_0 u'(p_0) - V(p_0; \bar{r}) > 0, \tag{30}$$

and it follows from the intermediate value theorem, (28), and (30) that the first-order condition (25) is satisfied by some $\tilde{p}$ with $p_0 < \tilde{p} < l$. It follows from (26) that the derivative of the objective function is weakly positive for $p < \tilde{p}$ and weakly negative for $p > \tilde{p}$ such that $\tilde{p}$ maximizes the objective function. We conclude that the belief cutoffs

$$(\underline{p}^{tr}, \overline{p}^{tr}) = (0, \tilde{p}) \tag{31}$$

are optimal. Moreover, given (28), any optimal upper belief cutoff satisfies $\overline{p}^{tr} < l$ and the first-order condition.

Now, we finish the proof of the theorem for Case 2. The inequality (9) follows directly from $\underline{p} = 0$. Theorem 2 states that, without remuneration, the optimal belief cutoffs are the pairs of beliefs $(\underline{p}^c, \overline{p}^c)$ that satisfy $\overline{p}^c \geq l$ and $\underline{p} \leq 1 - l$. Since $\tilde{p} < l$, the inequality (8) holds strictly. When $l < 1$, then, without remuneration, there are optimal belief cutoffs $(\underline{p}^{co}, \overline{p}^c)$ with $\underline{p}^c > 0 = \underline{p}^{tr}$. Hence, the inequality (8) holds strictly. This finishes the proof of the theorem.

Proof of Theorem 3 See the proof of Theorem 1 above.

B.2.3 Proof of Theorem 4 and Theorem 5

Proof of Theorem 4 Let p^* solve

$$u(p) + \bar{r} = u(1 - p). \tag{32}$$

It is easy to see that $p^* < 0.5$. Recall that $\overline{p}^c \geq l$ and $\underline{p}^c \leq 1 - l < 0.5$. If $1 - l < p^*$, then at the posterior belief cutoffs $\overline{p}^c$ and $\underline{p}^c$, the agent chooses x and y according to decision rule a_{tr} just like according to a_c. There is no decision effect and $Ev(\mathbf{a_{tr}}(p), \omega)|\tau^{co} = Ev(\mathbf{a_c}(p), \omega)|\tau^{co}$.

If $1 - l \geq p^*$, then for any lower belief cutoff $\underline{p}^c \in [0, p^*]$, there is also no the decision effect because the agent chooses x at $\overline{p}^c$ and y at $\underline{p}^c$.

However, for any lower belief cutoff $\underline{p}^c \in [p^*, 1 - l]$, the agent chooses x at $\underline{p}^c$ instead if they decide according to a_{tr}. Therefore with a_{tr}, the expected utility of the other if the lower cutoff is realized is

$$-Pr(Y|\underline{p}^c) = -(1 - \underline{p}^c). \tag{33}$$

Whereas with a_c, the expected utility of the other if the lower cutoff is realized is

$$-Pr(X|\underline{p}^c) = -\underline{p}^c. \tag{34}$$

Recall $\underline{p}^c < 0.5$, hence $-(1 - \underline{p}^c) < -\underline{p}^c$, i,e, the expected utility of the other if the lower cutoff is realized is lower with a_{tr} than with a_c. Since the probability that the lower cutoff is realized is pinned down by τ^c, and the expected utility of the other if the upper cutoff is realized is the same between the scenario with a_c and the scenario with a_{tr}, the expected utility of the other is strictly *lower* keeping τ^c fixed and changing a_c to a_{tr}. The decision effect is strictly negative, i.e. $Ev(\mathbf{a_{tr}}(p), \omega)|\tau^{co} < Ev(\mathbf{a_c}(p), \omega)|\tau^{co}$.

Proof of Theorem 5 We prove the theorem with an example. Consider u such that $p_0 < l < 1$ and $u''(x) \to \infty$ for $p \in [1 - l, l]$. When $r = 0$, it follows from Theorem 2 that a pair of optimal cutoffs are $\underline{p}^{co} = 1 - l$ and $\overline{p}^{co} = l$. When $r > 0$, $\underline{p}^{tr} = 0$ and $\overline{p}^{tr} \to l$, since these two points support the concave envelope.

First we prove that for this agent, the information effect is strictly positive.

What does the agent choose at each cutoff? It follows from (15) that, for any $r > 0$, the belief p^* where she is indifferent between x and y, i.e. $u(p^*) + r = u(1 - p^*)$, converges to $\frac{1}{2}$. So the agent chooses y at the two lower cutoffs $\underline{p}^{tr}$ and $\underline{p}^{co}$, and x at the two upper cutoffs $\overline{p}^{tr}$ and $\overline{p}^{co}$. That is, the decision effect (14) converges to zero.

Let us now derive the expected utility of the other with τ^{co} and τ^{tr}, when fixing $a_{tr}(p)$.

First, with τ^{co},

$$
\begin{aligned}
Ev(a_{tr}(p), \omega)|\tau^{co} &= -1 \cdot Pr(\underline{p}^{co})Pr(X|\underline{p}^{co}) + (-1) \cdot Pr(\overline{p}^{co})Pr(Y|\overline{p}^{co}) && (35) \\
&= -(Pr(\underline{p}^{co})(1 - l) + Pr(\overline{p}^{co})(1 - l)) && (36) \\
&= -(Pr(\underline{p}^{co}) + Pr(\overline{p}^{co}))(1 - l) && (37) \\
&= -(1 - l). && (38)
\end{aligned}
$$

Then with τ^{tr},

$$
\begin{aligned}
Ev(a_{tr}(p), \omega)|\tau^{tr} &\rightarrow -1 \cdot Pr(\underline{p}^{tr}Pr(X|\underline{p}^{tr}) + (-1) \cdot Pr(\overline{p}^{tr})Pr(Y|\overline{p}^{tr}) && (39) \\
&= -(Pr(\underline{p}^{tr}) \cdot 0 + \frac{p_0}{l}(1 - l)) && (40) \\
&= -\frac{p_0}{l}(1 - l). && (41)
\end{aligned}
$$

Since $p_0 < l$,

$$
Ev(a_{tr}(p), \omega)|\tau^{tr} > Ev(a_{tr}(p), \omega)|\tau^{co}, \qquad (42)
$$

In other words, we have proven that for this agent if $p_0 < l$, the information effect (16) is strictly positive.

We have already discussed above that for this agent the decision effect converges to zero. We hence can conclude that the overall effect is strictly positive. This finishes the proof.

B.2.4   Proof of Theorem 7

Proof of Theorem 7   Item 1 of Theorem 7 is a corollary of the second item of Theorem 6: if a preference type prefers no information over all possible information structures, clearly, she prefers no information over the fully revealing signals.

We prove item 2 of Theorem 7 by contradiction.

For any prior belief $p_0^l < p_0^h \in (0, 1)$, if an agent type prefers the prior to the fully

revealing signals at this prior then

$$\tau^{p_0^l} \;\succ\; \tau^{ce} \tag{43}$$

$$\Leftrightarrow r + u(p_0^l) \;>\; rp_0^l. \tag{44}$$

Suppose this agent prefers the fully revealing signals to prior p_0^h, then

$$\tau^{p_0^h} \;\prec\; \tau^{ce} \tag{45}$$

$$\Leftrightarrow r + u(p_0^h) \;<\; rp_0^h. \tag{46}$$

Subtract 44 from 46 and rearrange,we get:

$$\frac{u(p_0^h) - u(p_0^l)}{p_0^h - p_0^l} < r. \tag{47}$$

Since $u(\cdot)$ is concave and $p_0^l < p_0^h < 1$,

$$\frac{u(1) - u(p_0^h)}{1 - p_0^h} < r. \tag{48}$$

Since $u(1) = 0$, we get

$$\frac{-u(p_0^h)}{1 - p_0^h} \;<\; r, \tag{49}$$

$$\Rightarrow r + u(p_0^h) \;>\; rp_0^h, \tag{50}$$

$$\Rightarrow \tau^{p_0^h} \;\succ\; \tau^{ce}. \tag{51}$$

Contradiction. Hence $\tau^{p_0^h} \succeq \tau^{ce}$. In other words, $S(p_0^l) \subset S(p_0^h)$.

B.3 An Order of Other-Regarding Preferences

This section shows how the preference model of Section 3.1 allows for stable comparative predictions about differences in the information acquisition behaviour of

two decision-makers.

Theorem 1 and Theorem 5 illustrate that decision-makers acquire information about the consequences of their choices on others in a self-deceptive way. Some types exhibit a very strong form of self-deception, they avoid information completely; see Theorem 5. Others exploit information in the following sense: the optimal belief cutoffs $(\underline{p}^{tr}, \overline{p}^{tr})$ with remuneration $\bar{r} > 0$ are weakly smaller than any optimal belief cutoffs $(\underline{p}^c, \overline{p}^c)$ without remuneration, i.e. $r = 0$; see Theorem 1. Among those, some types exploit the information less strongly than others, meaning that the differences in the optimal belief cutoffs with and without remuneration, i.e. $\underline{p}^c - \underline{p}^{tr}$ and $\overline{p}^c - \overline{p}^{tr}$ are smaller.

The next result shows that there is a simple ordering other-regarding preference types that translates into an ordering of the predicted degree of self-deceptive behaviour: the lower the curvature of the belief utility, the more self-deceptive the agent behaves across *all* possible situations. We say that a preference type with belief utility u is *more self-deceptive* than a type with belief utility v if $u' < v'$ and write $u \succ_{dec} v$. For any type u, let

$$\underline{\delta}(u; \bar{r}) = \max \left[\underline{p}^{co}(u) - \underline{p}^{tr}(u) \right], \tag{52}$$

$$\overline{\delta}(u; \bar{r}) = \max \left[\overline{p}^{co}(u) - \overline{p}^{tr}(u) \right]. \tag{53}$$

where we take the maximum over all pairs of optimal belief cutoffs $(\underline{p}^{co}(u), \overline{p}^{co}(u))$ given $r = 0$ and all pairs pf optimal belief cutoffs $(\underline{p}^{tr}(u), \overline{p}^{tr}(u))$ given $\bar{r}$.

Theorem 8 *Let $u \succ_{dec} v$. Then for all $\bar{r} > 0$, the following holds.*

1. *If it is optimal for the v-type to avoid information completely given $\bar{r}$, then, this is also true for the u-type. The converse is not true.*

2. *If it is not optimal for the v-type to avoid information completely given $\bar{r}$, then*

either it is optimal for the u-type to avoid information completely given $\bar{r}$ or

$$\bar{\delta}(u;\bar{r}) > \bar{\delta}(v;\bar{r}),$$

$$\underline{\delta}(u;\bar{r}) \geq \underline{\delta}(v;\bar{r}).$$

Note that, given the normalization $u(1) = v(1) = 0$, the relation $u \succ_{dec} v$ implies that $v(0) < u(0)$. It follows from (5) that under certainty about the state $\omega = B$, type v chooses the other-regarding action y whenever u does. We see that the ordering $\succ_{dec}$ is an extension of the natural ordering of other-regarding preference types under certainty.

Proof. Let $u \succ_{dec} v$ and consider the situation with remuneration $\bar{r} > 0$. Let $\underline{p}(u)$ and $\tilde{p}(u)$ be the unique pair of beliefs supporting the concave envelope of the continuation value function V of the u-type and $\underline{p}(v)$ and $\tilde{p}(v)$ be the unique pair of beliefs supporting the concave envelope of the continuation value function V of the v-type. Recall that $\underline{p}(u) = \underline{p}(v) = 0$, given Lemma 2 and (22).

Consider the first item of the theorem. Lemma 2 says that it is optimal for the v-type to avoid information completely, given $\bar{r}$, if and only if $p_0 \notin [\underline{p}(v), \tilde{p}(v)]$. Similarly, it is optimal for the u-type to avoid information completely, given $\bar{r}$, if and only if $p_0 \notin [\underline{p}(u), \tilde{p}(u)]$. Since $\underline{p}(u) = \underline{p}(v) = 0$, to prove the first item of the theorem it suffices to show that

$$\tilde{p}(u) < \tilde{p}(u). \tag{54}$$

Note that the beliefs $\underline{p}(u)$ and $\tilde{p}(u)$ supporting the concave envelope of V satisfy

$$V(\tilde{p}(u);\bar{r}) - V(\underline{p}(u);\bar{r}) = u'(\tilde{p})(\tilde{p}(u) - \underline{p}(u)). \tag{55}$$

Since $\underline{p}(u) = \underline{p}(v) = 0$ and $V(0,\bar{r}) = 0$, this implies that $\tilde{p}(u)$ satisfies the condition

$$pu'(p) - V(p;\bar{r}) = 0; \tag{56}$$

75

compare to the first-order condition (25). Similarly, $\tilde{p}(v)$ satisfies

$$pv'(p) - V(p; \bar{r}) = 0; \tag{57}$$

Therefore, if

$$\begin{aligned}
\forall p : pu'(p) - V(p; \bar{r}) &> pv'(p) - V(p; \bar{r}), \\
\Leftrightarrow \forall p : pu'(p) - u(p) &> pv'(p) - v(p), \tag{58}
\end{aligned}$$

then (54) holds. We rewrite (58) using $u(1) = v(1) = 0$,

$$\forall p : pu'(p) + \int_p^1 u'(p)dp > pv'(p) + \int_p^1 v'(p)dp. \tag{59}$$

Clearly, $u' > v'$ implies (59). This finishes the proof of the first item.

Consider the second item of the theorem. Given Lemma 2, if it is not optimal for the type to avoid information completely, then, $p_0 < \tilde{p}(v)$ and the optimal belief cutoffs of the v-type given $\bar{r}$ are $\underset{\sim}{p}(v) = 0$ and $\tilde{p}(v)$. Given (54), we have to distinguish two cases.

Case 1 $\tilde{p}(u) \leq p_0$

Then, it follows from given Lemma 2 that it is optimal for the u-type not to acquire any information. This finishes the proof of the second item in this case.

Case 2 $p_0 < \tilde{p}(u) < \tilde{p}(v)$

Then, it follows from Lemma 2 that the optimal belief cutoffs of the u-type given $\bar{r}$ are $\underset{\sim}{p}(u) = 0$ and $\tilde{p}(u)$. Consider $l(v) = \min\{p \in [0,1] : v(p) = 0\}$ and $l(u) = \min\{p \in [0,1] : u(p) = 0\}$. Note that $u \succ_{dec} v$ implies $l(u) > l(v)$. The claim of the second item of the theorem follows from the characterization of the optimal belief cutoffs without remuneration in Theorem 1 and from (54). ∎

B.4   Parametric Examples

Isoelastic Belief Utility   Let $u(p) = -\alpha(1-p)^n$ for some $n > 1$. The parameter α moderates how an individual with perfect knowledge would value the interest of others relative to her own. The parameter n captures how the agent values the interest of others when his belief changes; formally, n is the elasticity of the belief utility function as a function of $q = 1 - p$, that is as a function of the belief that the option is harmful to the other.[24]

Given Theorem 1, the agent's optimal belief cutoffs are weakly smaller with remuneration $\bar{r} > 0$ than without if it is not optimal to avoid information completely given $\bar{r}$. Note that $u'(1) = 0$ for all $n > 1$ such that it follows from the proof of Theorem 1 (see Case 2, in particular (30)) that it is not optimal to avoid information completely if

$$
\begin{aligned}
0 \ &< \ p_0 u'(p_0) - u(p_0) - r \\
\Leftrightarrow r \ &< \ \alpha(1-p_0)^{n-1}((1-p_0) - n) \\
\Leftrightarrow \alpha \ &> \ \frac{r}{(1-p_0)^{n-1}((1-p_0) - n)}.
\end{aligned} \tag{60}
$$

Since $n > 1$, the right hand side is negative and the condition (60) is generally fulfilled. So, the condition of Theorem 1 is fulfilled. Since $u'(1) = 0$ for all $n > 1$, it follows from Theorem 1 that the upper belief cutoff is strictly smaller with remuneration $\bar{r} > 0$ than without.

Linear Belief Utility   [25] If $u(p) = \alpha(p - 1)$, then, given (5), she chooses x at belief $p = \Pr(\alpha)$ if and only if

$$
\begin{aligned}
\alpha(p - 1) + r \ &\geq \ -\alpha p \\
\Leftrightarrow 2\alpha p \ &\geq \ \alpha - r \\
\Leftrightarrow p \ &\geq \ \frac{1}{2} - \frac{r}{2\alpha}.
\end{aligned} \tag{61}
$$

---

[24]The elasticity of a differentiable function $f(k)$ at k is defined as $\frac{\partial f}{\partial k} \frac{k}{f(k)}$.

[25]The assumption of linear belief utility means that the agent is an expected utility maximizer.

77

She always prefers x regardless of her belief if

$$\frac{1}{2} - \frac{r}{2\alpha} \leq 0$$
$$\Leftrightarrow \alpha \leq r. \tag{62}$$

If (62) holds, it is optimal not to acquire any information and choose x. Conversely, when she is sufficiently altruistic, i.e. when $\alpha > r$, it is optimal to get fully informed about the state and choose the action that is harmless to the other in both states, i.e. x in X and y in Y.