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Abstract

We experimentally investigate whether individuals strategically distort their beliefs about dominant norms. Embedded in the context of lying, we systematically vary both the nature of elicited beliefs (descriptive about what others do, or normative about what others approve of) and whether subjects are aware of the forthcoming lying opportunity at the belief-formation stage. We build a dual-self model of belief distortion applied to the context of social norms and derive a number of precise predictions. Our findings provide a perspective on why, when and which norm-relevant beliefs are strategically distorted and show that not all belief distortions are created equal.

JEL-Codes: C720, C910, D800, D900.

Keywords: lying, social norms, strategic beliefs, uncertainty.

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Jerry tries to find a way to trick a lie detector

George Costanza: "Jerry, just remember...it's not a lie if you believe it!"

Seinfeld, TV Show, "The Beard" (Season 6, Episode 16, 1995)

1. Introduction

Social norms can be powerful motivators to guide and change behavior. They inform both our individual behavior and our interactions with others in a variety of economically interesting domains such as collective action, altruistic sharing, deviant behavior and discrimination.[1] While the consensus from relevant literature is that social norms can play an important role in motivating and guiding behavior (Sutter et al., 2010; Bowles and Gintis, 2011; Bartling and Schmidt, 2015; Fehr and Schurtenberger, 2018; Bicchieri et al., 2019b; Bursztyn et al., 2019), more work is needed to understand how norm-following operates. This is particularly relevant to the realm of policy-making, where so-called norm nudges – usually in the form of providing subjects with information on how other people behave or what is deemed appropriate – have been used in a range of domains, from tax compliance to charitable giving and energy consumption, with mixed results. While some interventions are successful, others fail to produce the desired behavior or even backfire.[2]

To predict the effect of norm nudges on behavior, it is important to first understand how people form beliefs about prevailing norms in the benchmark case where beliefs are formed *without* additional information provided by the researcher. Recent experimental evidence has pointed out that individuals may choose to strategically entertain beliefs that justify evading costly pro-social behavior (Babcock et al., 1995; Di Tella et al., 2015; Exley, 2015; Gneezy et al., 2018c).[3] The literature calls these "motivated beliefs" (Kunda, 1990;

[1] E.g., Cialdini et al. (1990); Ostrom (2000); Bicchieri (2006, 2016); Krupka and Weber (2013); Gächter et al. (2017); Barr et al. (2018); Chyn (2018); Bott et al. (2019); Choi et al. (2019); Dimant et al. (2019).

[2] For a recent methodological discussion of the theoretical and empirical literature on norm nudges see Bicchieri and Dimant (2019). Examples of successful norm-based interventions nudges include (Dal Bó and Dal Bó, 2014; Hallsworth et al., 2017; Hernandez et al., 2017; Bott et al., 2019), while examples of no effect include (Blumenthal et al., 2001; Fellner et al., 2013; Cranor et al., 2018; Dimant et al., 2019; Dunning et al., 2019). Finally, the studies by John and Blume, 2018; Bicchieri et al., 2019b provide illustrations of interventions which actually backfired.

[3] Also see Chen and Gesche (2017); Ging-Jehli et al. (2019); Exley and Kessler (2018); Exley (2019). Another branch of the literature (such as Saucet and Villeval, 2019) focuses instead on *backward looking* belief distortion that documents selective recalls of past actions.

Bénabou, 2015; Bénabou and Tirole, 2016; Gino et al., 2016). Motivated beliefs are usually formed in environments where they provide a plausible and acceptable justification for self–serving behavior. For instance, one may feel justified to behave selfishly in a dictator game if one believes that the recipient is corrupt, but not otherwise (Di Tella et al., 2015).

Our paper extends the debate and investigates motivated beliefs within the previously unexplored context of beliefs about the (non)existence of pro-social norms in a given environment. To what extent are people willing and able to distort their beliefs about the prevalence and acceptability of selfish behavior? We propose a novel theoretical and experimental perspective that connects the interdisciplinary research on social norms to the theoretical and empirical economic research on motivated beliefs. Our working assumption is that there is often uncertainty about whether a norm applies or whether appropriate norms are followed. For instance, even with a generic norm against lying, some lies ("white lies") are commonly practiced and considered acceptable (Erat and Gneezy, 2012). Other lies, however, clearly aren't. Between these extremes is a grey area of uncertainty over how people may behave or what people may approve of in a given situation.[4] When we are uncertain, we form beliefs by drawing upon similar experiences or shared cultural narratives (Shiller, 2017; Bénabou et al., 2018a), a process susceptible to self-serving distortion.

We have two primary goals which have not yet been investigated in the existing literature. First, we want to determine whether self-serving belief distortion aimed at evading costly pro-social behavior also applies to beliefs about norms. The answer to this question depends on the underlying motivations for belief distortion. For instance, if the purpose of belief distortion is to "feel moral whilst acting egoistically" (as in Gino et al., 2016), then distorting one's beliefs about the dominant social norm seems futile. Intuitively, in the absence of additional moral justifications (such as for instance the belief that the recipient in a dictator game is corrupt, as in Di Tella et al., 2015 cited above), a moral individual would not normally behave selfishly, lie or cheat, independently of her beliefs about what others do or approve of. Morality, in other words, is socially unconditional. However, if behavior is conditional on the perceived social norm and thus on what one believes to be common and/or accepted, then justification of selfish behavior will take the form of manipulation of these beliefs. We should thus be careful to distinguish behavior that is morally motivated from behavior that is motivated by adherence to social norms, as belief

[4]Lying is defined as asserting something false with the intention to mislead (Isenberg, 1968; Sobel, 2019).

distortion takes different forms in the two contexts.

Our second goal relates to the nature of norm belief distortion. Beliefs about the dominant norm include two components: beliefs about what others do in the same situation (empirical expectations), and beliefs about what others approve of (normative expectations) (Bicchieri, 2016, 2006). Since individuals engage in strategic belief distortion in order to justify their choices, it is important to understand what kind of belief distortion (if any) yields behavioral change. From a policy perspective, this can inform behavioral interventions in the form of appropriate norm nudges (Benartzi et al., 2017).

We embed our analysis within the context of the lying literature (e.g., Abeler et al., 2019; Gneezy et al., 2018a; Gerlach et al., 2019), by employing a variant of the 'dice under the cup' paradigm (Shalvi et al., 2011; Fischbacher and Föllmi-Heusi, 2013). This task (and variations of it) has been shown to predict rule violations in natural settings, and has been used as a proxy to measure the prevalence of rule violations across societies.[5] We consider a variant of this paradigm in which subjects' beliefs are elicited in stage 1 before they perform a dice task in stage 2. In stage 1, we employ an incentive-compatible belief elicitation protocol in which we randomly elicit subjects' beliefs on either the honest/dishonest behavior adopted by the majority of subjects in a previous session, or the approval of honest/dishonest behavior by the majority of previous participants. The belief elicitation process prompts belief formation, as subjects process and interpret information drawing on past experiences and shared narratives.

Our main experimental intervention is to randomly vary whether participants are aware or unaware of an upcoming opportunity to lie when they form their beliefs.[6] We hypothesize that when subjects are aware of the upcoming lying opportunity when they form their beliefs (what we call the *Cheating Possibility Known*, CPK, treatment), the belief formation process may entail distortion in order to justify lying in the subsequent task. By contrast, distortion will not occur when subjects form their beliefs *before* finding out that they

[5] Cohn et al. (2015); Gächter and Schulz (2016); Hanna and Wang (2017); Cohn and Maréchal (2018); Cohn et al. (2019). Note that while this is a convenient workhorse for the purpose of our examination, the implications that we are able to derive are not limited to this particular context, but are instead aimed to contribute more generally to our understanding of social norms and how we process them when those prescriptions clash with one's individual preference for deviance.

[6] The "before" versus "after" manipulation has been employed in the literature to measure belief distortion about which bargaining outcome is fair (as in Babcock et al., 1995) or which investment opportunity delivers higher return (as in Chen and Gesche, 2017; Gneezy et al., 2018b).

will soon engage in the dice task (what we call the *Cheating Possibility Unknown*, CPU, treatment. In this case, beliefs will be unbiased. We compare these two treatments to test when belief distortion occurs, identify which beliefs are more apt to be distorted, and how belief distortion subsequently affects behavior.[7]

To inform our empirical investigation, we build a theoretical model that borrows from Bicchieri's (2006) theory of social norms. Much of the behavioral literature assumes that the norm against lying has been internalized so that people become desensitized to what others do or approve of. In contrast, we focus on the behavior of conditional norm-followers, who may or may not choose to lie depending on what they believe is the dominant social norm. Intuitively, believing that lying is common – or that most people do not disapprove of it – rules out an honesty norm in this context. Thus, a conditional norm-follower would find it easier to lie, since the condition for obeying the norm is not present.[8]

We consider a dual-self model in which the (material) payoff-maximizing self may want to distort the beliefs of the conditional norm-follower self to ensure that he is not "tempted" to behave honestly (and thus forego a material reward). Our optimal beliefs model stands in the tradition of Brunnermeier and Parker (2005); Bénabou and Tirole (2006a); Bénabou (2015); Bénabou and Tirole (2016), albeit within the novel context of norm-following.[9]

Our empirical results are consistent with our theoretical model. As expected, in the empirical treatment subjects engage in belief distortion: when aware of the upcoming lying task, they are more likely to believe that lying is widespread and are more likely to lie, compared to when their beliefs are formed *before* they become aware of the lying task ahead. Conversely, in the normative treatment we find that the subjects' elicited beliefs are independent of whether or not they are aware of the upcoming lying opportunity, which suggests that belief distortion does *not* occur. Lying rates are indistinguishable in both cases, and are as high as they are in the empirical treatment with belief distortion. Our interpretation is that in the normative treatment, self-serving belief distortion is *not* necessary to induce lying since believing that the majority disapproves of lying does not

[7] While our main focus if self-serving belief distortion, in the Appendix we also look at belief manipulation in other-regarding domain as a robustness test of our theoretical model. We also consider a baseline treatment in which belief elicitation is omitted.

[8] For recent empirical evidence see Bicchieri et al. (2019a).

[9] Our analysis also contributes to the game theory literature on strategic information transmission in the context of norms – see e.g.,Bénabou and Tirole (2006a); Sliwka (2007); Adriani and Sonderegger (2009, 2018); Adriani et al. (2018) – and applies its insights to belief distortion.

inhibit one's own lying. This stands in contrast with the empirical treatment, where we find that belief distortion, in the form of convincing oneself that lying is widespread, is needed to enable lying in the subsequent task. We argue that these findings are inconsistent with a number of interpretations, including the notion that subjects may want to distort their beliefs in order to avoid feeling "immoral" when lying (as in Rabin's (1994) theory of moral dissonance).[10] At the same time, our empirical findings are consistent with our norm-based model under the condition that there is an asymmetry between what we can infer from empirical as opposed to normative information: widespread honest behavior is a strong indicator of disapproval of lying (and thus that a norm of honesty exists and is followed), but the opposite does not hold. Widespread disapproval of lying is not necessarily a strong indicator that most people behave honestly. Even if most people express disapproval of lying, a norm against lying may not be followed.

To confirm this hypothesis, we ran a follow-up experiment in which new subjects chose the statement they most agreed with after being provided information about either the lying behavior or the approval of lying of participants in a previous dice task experiment. We compared two conditions in which we provided one truthful part of the social norm information (empirical or normative) to infer the beliefs about the other part (normative or empirical). In the first condition, subjects were informed that the majority of individuals in the dice experiment refrained from lying, and were asked to guess how many subjects in that experiment disapproved of lying. In the second condition, subjects were informed that the majority of individuals in the dice experiment disapproved of lying and were asked to guess how many subjects in that experiment refrained from lying. Our findings support the hypothesis that while people interpret honest behavior as a strong indicator of disapproval of lying, disapproval of lying is not seen as a strong guarantee of honesty; 'walking the talk' is a more costly signal and thus more predictive than cheap talk of normative (dis)approval. Our follow-up experiment contributes to an ongoing discussion in the existing literature (e.g., Eriksson et al., 2015) on the extent to which learning about common behavior leads to inferences about what is commonly approved of.

When comparing all treatments within the main experiment, we find that in the empirical CPU treatment, where beliefs are elicited *before* subjects become aware of the upcoming dice task (and are thus unbiased), reports of the winning number are substantially *lower*

[10] The model of moral dissonance and alternative theoretical interpretations are discussed in Section 5.

than in all other treatments, where lying rates are essentially equivalent. Our interpretation is that forming unbiased beliefs prevents subjects from engaging in further belief distortion, even if they are eventually confronted with a lucrative lying opportunity in the form of the dice task. In the empirical CPU treatment subjects are consequently less prone to misreport the winning number than in the other treatments.[11] This suggests that belief distortion occurs during the process of belief formation and not afterwards when beliefs are already formed and one would need to justify belief change (e.g., new compelling evidence). This is consistent with literature on "belief stickiness": once people form their beliefs it is hard to change those beliefs even when doing so would be materially beneficial (e.g., Falk and Zimmermann, 2017; Gneezy et al., 2018b,c).

Finally, when looking at behavior in the baseline condition where belief elicitation is omitted and subjects are immediately engaged in the dice task, we find that lying rates are the same as when beliefs are elicited and subjects are aware of the lying task ahead. As predicted by the theory, this result confirms that the belief elicitation task is not necessary for subjects to engage in belief distortion. Self-serving belief distortion may also occur when subjects are not explicitly asked by the experimenter to state their beliefs.

The remainder of the paper is organized as follows. We describe the experimental design in Section 2. To derive testable hypotheses, we develop a new model of belief distortion in Section 3. The results are presented in Section 4. In Section 5, we address a number of alternative models, including the possibility that belief distortion costs may depend on the nature of the belief to be distorted or that stated beliefs may be used by subjects as a signaling device. We also discuss the predictive power of moral dissonance as formalized by Rabin (1994), image motivations (Bénabou and Tirole, 2006b; Gneezy et al., 2018a; Abeler et al., 2019), and pure conformity. Section 6 concludes.

2. Experimental Design

2.1. General Procedure

Our data collection is subdivided into several self-serving experiments – results of which are presented in the main body of this paper, and several other-regarding experiments, the

[11] This occurs for empirical, but not normative, beliefs since, as explained, in that treatment (but not in the normative treatment) conditional liars resort to self-serving belief distortion to justify lying in the dice task.

results of which presented in the Appendix and intended as robustness checks of the theory. We present the aggregate data collection below and a detailed breakdown of observations per treatment at the bottom of the respective figures in the result sections. For the data analyzed in the main body of the text, we capitalize on:

- Pre-experimental data collection to obtain the truthful empirical and normative information for subsequent incentive-compatible belief elicitation → 100 data points
- Data collection for the main belief-distortion and lying experiment (Baseline plus all normative and empirical CPK and CPU treatments) → 724 data points
- An additional experiment to examine specific theory predictions → 300 data points

Nested in a non-interactive setting of our study, all data was collected on Amazon Mechanical Turk (MTurk), which is particularly well suited for our design and has been similarly used in recent research (Kuziemko et al., 2015; DellaVigna and Pope, 2017). Literature related to our research agenda has successfully used variants of cheating paradigms and norm-nudge interventions on MTurk (Bicchieri et al., 2019a; Bolton et al., 2019). In addition, Gerlach et al. (2019) find that behavior in various cheating paradigms is comparable between the laboratory and MTurk participants. Importantly, recent literature indicates the robustness, generalizability, and reproducibility of laboratory findings (Arechar et al., 2018; Coppock et al., 2018; Snowberg and Yariv, 2019). To ensure high quality data collection on MTurk, we utilize a combination of CAPTCHAs and sophisticated screening questions to avoid pool contamination. We applied the following restrictions to the participant pool: participants had to be in the U.S., approval rate was greater than 99%. We used online tools to test IPs for low quality respondents. Any residual noise would be uncorrelated with the treatments and work against us.[12] The mean age of the participants was 35.5 years and 49.8% of them were female. The average duration of the experiment from start to finish was 6 minutes and participants earned on average $0.95 equivalent to an average hourly payoff of $9.50 (including a show-up fee of $0.5, equivalent to $5 per hour) and is well above average MTurk pay (Hara et al., 2018).[13]

[12] To achieve sufficient statistical power, our data collection was informed by a pre-test also used in Dimant et al. (2019) (for details, see pre-registration documents on AsPredicted.org #23244 and #23283). At least 110 observations per treatment arm had to be collected to achieve a moderate effect size of approximately 0.39, power of 0.8, and an alpha of 0.05. To account for noise in the data that may render some data points invalid, we aimed to collect about 125 usable data points per treatment.

[13] Noteworthy, recent evidence suggests that pay rates above what is typically considered an 'ethical'

2.2. Treatments

We introduce two between-design dimensions along which our experiment varies (we refer to the treatment combinations as depicted in Figure 1):

I) Whether belief elicitation concerned normative or empirical expectations

II) Whether participants were aware, prior to the belief elicitation phase, that they would play the dice task

2.3. Detailed Procedure

Following the treatment randomization, the remainder of the experiment consists of two parts: the belief-elicitation phase and the dice task.[14]

Part I: Belief Elicitation Regarding Behavior/Beliefs of Others in Dice Task

The first stage of each treatment consisted of a belief-elicitation procedure in which participants reported their beliefs about either majoritarian behavior (empirical treatment) or majoritarian normative convictions (normative treatment) in a previous session.

Upon signing a consent form, reading the instructions (see Appendix for screenshots), and passing a number of comprehension questions, participants were first presented with the incentivized belief-elicitation task. The belief task asked participants to indicate which of the two mutually exclusive statements presented to them was true. The truthfulness of the statements was based on the results from the pre-experimental survey. We used data from a trial session that included questions regarding the appropriateness of lying on the task. From this sample, we collected both empirical and normative information about the frequency and appropriateness of lying and used the information as part of the incentivized belief elicitation in the main experiment. At this point, depending on the exact treatment (details below), participants may or may not have already been aware that they will be engaging in the dice task with a cheating opportunity following the belief elicitation.

When presented with two mutually exclusive statements in the belief elicitation, participants had to choose one statement. A correct answer increased the participants' payoff

MTurker wage among social scientists (about $6) does not further increase performance in the realm of attention or engagement (Andersen and Lau, 2018).

[14]The different parts of the experiment had no names to avoid potential priming.

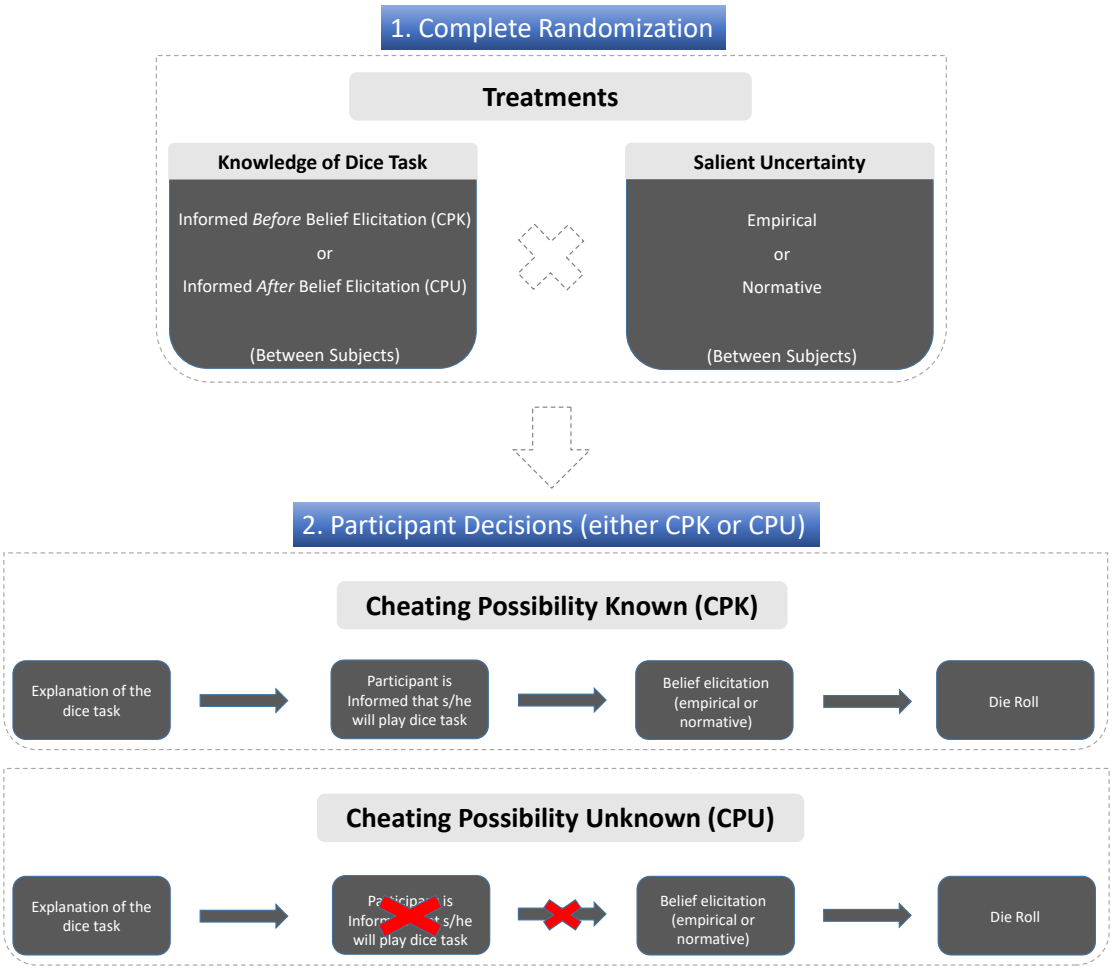

Figure 1: Experimental procedure.

by \$0.25 (equivalent to \$2.5 per hour). The accuracy of the guesses was revealed only at the very end of the experiment and thus participants were not made aware of the actual truthfulness of the presented statements before the lying opportunity. This procedure was necessary in order to ensure that whether a norm of honesty applies to the situation remained uncertain (i.e. participants were not sure if their selected statement was correct) and did not directly affect participant behavior in the dice task. The statements presented to the participants varied across treatments (see Figure 1) as follows:

Normative Treatment:

Please read the following statements and determine whether you believe them to be true or false. Which statement is true?

"In a similar study, most people said it is OK to lie for your own benefit."

or

"In a similar study, most people said it is not OK to lie for your own benefit."

Empirical Treatment:

Please read the following statements and determine whether you believe them to be true or false. Which statement is true?

"In a similar study, most people lied for their own benefit."

or

"In a similar study, most people did not lie for their own benefit."

It is important to note that this paper does not examine the impact of providing new information on behavior; i.e., we do not compare a situation where there is norm uncertainty versus one in which subjects are informed that a norm applies and is followed (as partially addressed by Dimant et al., 2019). Instead, we are interested in how people may distort their beliefs in a self-interested manner. Aside from the Baseline, in all treatments the participants' beliefs regarding only one aspect (empirical or normative) that is instrumental in determining whether a norm of honesty applies or not were elicited.

Part II: Dice Task

After submitting their guess, participants were presented with the dice task. Participants clicked on a button to roll the electronic 6-sided dice and saw the outcome of the roll on their screen. Following the roll, participants were asked to write the outcome of the roll into an input field. Participants were told that there was no deception in the study, that the roll generator was fair and its outcome untraceable by the experimenter. Reporting a "5" yielded a payoff of \$0.25 (the equivalent of \$2.5 per hour), while reporting any other number yielded a zero payoff. Afterwards, participants received the respective payments and were asked to complete a post-experimental questionnaire.

To study the relevant mechanisms at hand, the dice task was employed in one of two ways. In the **Cheating Possibility Known (CPK)** treatments, the dice task was public knowledge and announced *before* the belief elicitation phase. In the **Cheating Possibility Unknown (CPU)** treatments, the subsequent dice task was announced *after* the belief elicitation phase. This fine distinction allows us to test whether belief distortion occurs and its influence on subsequent behavior.

Importantly, to make treatments comparable, participants were always explained the mechanics of the dice task at the *beginning* of all treatments, i.e. *before* the belief elicitation phase. This ensured that participants knew which task the presented empirical and normative information referred to. What varied between the CPK and CPU conditions was the explicit mention of whether the participants themselves would engage in the task after the belief elicitation. This ensures that any potentially observable belief distortion mechanism cannot be explained by demand effects since, by design, their existence would merely produce a level effect and be unable to explain differences within the same treatment. For the purpose of comparison, we also ran a baseline condition in which participants only played the dice task without having been asked to express their belief in a previous stage.

3. Theoretical Examination

In this section, we present a simple theoretical model of belief distortion in the spirit of Bénabou and Tirole (2006a, 2011, 2016). We start by building a general setup that models belief distortion abstracting from the precise reasons underpinning the conditionality of subjects' behavior on their expectations. We then add more structure, proposing a norm-based theoretical account of why expectations may matter for subjects' behavior.[15] All our results are proved in the text unless otherwise specified.

Conditional and unconditional individuals

We consider a setup where individuals belong to one of three types: (i) Unconditional Liars (UL) – always lie if this generates a positive monetary return for them. (ii) Uncon-

[15] In Section 5, we discuss possible alternative models, including (i) belief distortion costs depend on the nature of the belief to be distorted, (ii) belief distortion is motivated by psychological (rather than material) considerations, (iii) the relevant dichotomy is not majority/minority (iv) subjects use stated beliefs as signaling devices, (v) conditional liars are concerned with avoiding cognitive or moral dissonance (vi) conditional liars are concerned with maintaining reputation for honesty or other forms of image concerns, (vii) conditional liars are motivated by pure conformity.

ditional Honest (UH) – incur a prohibitively high cost from lying and, as a result, do not lie. (iii) Conditional Liars (CL) – may choose to lie or not depending on what they believe about the underlying state of the world. Differently from the other types, conditional liars may have an interest in distorting their beliefs in order to affect their future behavior.

Let the share of UL be denoted as α_{UL} and the share of UH as α_{UH}; the share of CL is $1-\alpha_{UL}-\alpha_{UH}$. The precise values of α_{UH} and α_{UL} are not perfectly observed and depend on the specific nature of the situation at hand.[16] There are two possibilities:

- with probability $q \in (0,1)$: $\alpha_{UH} = h$ and $\alpha_{UL} = l$;
- with probability $1-q$: $\alpha_{UH} = l$ and $\alpha_{UL} = h$,

where $h > 1/2 > l$ and $1-h-l > 0$. Our assumptions ensure that when the share of unconditional truth-tellers is high, the majority of subjects tell the truth (independently of what CL do), while when the share of unconditional truth-tellers is low, the majority of subjects lie.

States of the world

A state of the world is defined as a pair (a, m), where a indicates majoritarian behavior and m indicates the normative convictions held by the majority. We assume that all individuals belonging to the same unconditional type hold the same normative convictions. With probability $g \in (0,1]$ all UH types disapprove of lying, while with remaining probability $1-g$ they believe lying is morally acceptable. Similarly, the probability that individuals of type UL disapprove of lying in a given situation is $r \in (0,1]$, while the probability that they believe lying to be acceptable in is $1-r$. The following table provides a summary of the possible states of the world, with their prior probabilities. In the table, $a = T$ (resp., L) indicates the action of telling the truth (lying), and $m = W$ (resp., R) indicates the

[16] The underlying idea is that the specific nature of the situation at hand will influence the lying costs of "unconditional" individuals, and this in turn will determine the share of UH and UL. The use of the term "unconditional" refers to the fact that the behavior of these individuals is not motivated by their beliefs about the state of the world. However, this does not preclude that their lying costs may differ depending on the specific details of the dilemma they are presented with. We treat the mechanism through which this happens as a black box, since our main focus of interest are type CL.

normative conviction that lying is wrong (right).

Prior probability	Majoritarian behavior	Majoritarian normative conviction	State
qg	$a = T$	$m = W$	state H1
$q(1-g)$	$a = T$	$m = R$	state H2
$(1-q)\,r$	$a = L$	$m = W$	state L1
$(1-q)\,(1-r)$	$a = L$	$m = R$	state L2

(1)

Belief Elicitation

At $t = 0$, before the lying/not lying decision, subjects are asked to report their beliefs about the share (majoritarian/minoritarian) of

(i) people who lie (*Empirical treatment)*, or

(ii) people who believe that lying is unacceptable (*Normative treatment).*

Belief about majoritarian behavior elicited in the empirical treatment is denoted as $b_a \in \{b_T, b_L\}$, while belief about majoritarian normative conviction elicited in the normative treatment is $b_m \in \{b_R, b_W\}$. To answer the belief elicitation question, subjects must engage in information processing: they retrieve information from past experiences, historical evidence and other relevant sources, and process it into a fully-formed belief. These beliefs are then used at $t = 1$, when CL subjects decide whether or not to lie. For simplicity, the monetary incentives present in the belief elicitation task are ignored in this stylized model, but explicitly accounted for in the robustness section presented in the Appendix.

Lying decision

Since UL agents always lie and UH never do, the decision to lie or not only concerns CL. In what follows, we focus exclusively on lies that generate a positive monetary return for the subject, and take the form of dishonestly reporting the winning number in order to obtain the monetary transfer $\mu > 0$.[17] Let u_{S} denote the non-monetary (dis-)utility from lying for a CL type when the state is S. Since subjects cannot observe the state, they choose

[17] As will become clear below, subjects will never choose to distort beliefs to engage in lying behavior that generate zero or negative monetary returns (such as reporting a losing number when drawing the winning number). These types of lies are therefore ignored here.

their behavior by computing the expected return from lying. The expected non-monetary component of utility from lying is,

$$E\left[u(b)\right] = u_{\mathrm{H1}}\Pr(\mathrm{H1} \mid b) + u_{\mathrm{H2}}\Pr(\mathrm{H2} \mid b) + u_{\mathrm{L1}}\Pr(\mathrm{L1} \mid b) + u_{\mathrm{L2}}\Pr(\mathrm{L2} \mid b)$$

where $\Pr(\mathrm{S} \mid b)$ is the probability that the subject assigns to state S given belief b (more on this below). At t=1, the utility of a conditional liar can be expressed as

$$\left[E\left[u(b)\right] + \mu\right] \parallel_{lie} \tag{2}$$

where $\parallel_{lie}$ is an indicator function that takes value 1 if the subject lies, and value 0 otherwise. Conditional liars thus choose to lie if,

$$E\left[u(b)\right] + \mu > 0 \tag{3}$$

where the left hand side of (3) is the total expected return from the lie, and tell the truth otherwise.[18]

Consistency requirement

At $t = 1$, CL's decision to lie or not depends on their beliefs about the underlying state of the world, as described in (3). We impose the following consistency requirement. Given b_a or b_m formed at $t = 0$, beliefs about the likelihood of state S occurring are derived from Bayes' rule, as follows:

$$\Pr(\mathrm{S} \mid b_a) = \frac{\Pr(a \mid \mathrm{S})\ \Pr(\mathrm{S})}{\Pr(a)} \text{ and } \Pr(\mathrm{S} \mid b_m) = \frac{\Pr(m \mid \mathrm{S})\ \Pr(\mathrm{S})}{\Pr(m)}]$$

This requirement imposes restrictions on the beliefs that subjects may hold about the state of the world.[19] If, for instance, g is large, then this implies that a subject who has formed the belief that the majority tell the truth at $t = 0$ also needs to acknowledge that the majority are likely to disapprove of lying, and, consequently, that the state of the world is likely H1.[20] More precisely, in the empirical treatment, the consistency requirement implies

[18] We adopt the convention that, if indifferent, at t=1 a conditional liar will not lie.

[19] For convenience, we assume that subjects are unaware that their beliefs b_a or b_m formed at $t = 0$ may have been distorted, although the model can be generalized to account for this possibility.

[20] We follow previous literature such as Brunnermeier and Parker (2005); Oster et al. (2013) and assume that updating from belief b follows Bayes rule. Recent literature has highlighted that, in a number of settings

that $t = 1$ beliefs satisfy: $\Pr(\text{L1}|\ b_T) = \Pr(\text{L2}|\ b_T) = \Pr(\text{H1}|\ b_L) = \Pr(\text{H2}|\ b_L) = 0$ and

$$\begin{cases} \Pr(\text{H1} \mid b_T) = g \\ \Pr(\text{H2} \mid b_T) = 1 - \Pr(\text{H1} \mid b_T) \\ \Pr(\text{L1} \mid b_L) = 1 - r \\ \Pr(\text{L2} \mid b_L) = 1 - \Pr(\text{L1} \mid b_L) \end{cases}$$

In the normative treatment, $t = 1$ beliefs satisfy: $\Pr(\text{H2}|\ b_W) = \Pr(\text{L2}|\ b_W) = \Pr(\text{H1}|\ b_R) = \Pr(\text{L1}|\ b_R) = 0$ and

$$\begin{cases} \Pr(\text{H1} \mid b_W) = \frac{qg}{(1-q)r+qg} \\ \Pr(\text{L1} \mid b_W) = 1 - \Pr(\text{H1} \mid b_W) \\ \Pr(\text{H2} \mid b_R) = \frac{q(1-g)}{q(1-g)+(1-q)(1-r)} \\ \Pr(\text{L2} \mid b_R) = 1 - \Pr(\text{H2} \mid b_R) \end{cases}$$

Self-Serving Information Processing

We now turn to information processing at t=0**.** As we have seen, beliefs formed at the elicitation stage affect the subject's posterior beliefs about the likelihood of different states of the world and thus the decision to lie or not. This opens the door to the possibility that, at the belief formation stage, the individual may gain from engaging in self-serving belief distortion. Gino et al. (2016) use the term *motivated Bayesian* to capture the notion that, when processing and encoding past experiences, historical narratives etc. into beliefs, people may do so in a biased way, in order to generate a self-serving interpretation of reality (what the literature calls "motivated beliefs"). Distortion takes the form of ignoring or underweighting "unfavorable" evidence, or conveniently "massaging" the inferences being drawn, in a direction that suits the decision maker's material interests. Our analysis follows this approach and assumes that conditional agents behave as motivated Bayesians.[21] Similar to Di Tella et al. (2015), we do not model the belief distortion process explicitly,

(e.g., overconfidence) people stray away from the Bayesian benchmark (Zimmermann, 2019; Harrison and Swarthout, 2019). Clearly enough, our theoretical predictions would continue to apply for more general updating processes so long as we impose some minimal consistency requirements, such as, e.g., that if the majority tell the truth then it is likely that the majority also disapprove of lying.

[21] UL and UH types do not engage in belief distortion since their behavior in the lying task is independent of their expectations.

and instead adopt a black-box approach (see Bénabou and Tirole, 2016 for a discussion of possible underlying distortion processes).

Let the cost of belief distortion be denoted as c. For simplicity, in what follows we focus on the case $c = 0$. This is a parsimonious benchmark, but is inconsequential for our hypotheses, which are independent of the exact value taken by c.[22] At t=0, conditional agents choose their beliefs by focusing *exclusively* on material payoff, namely $\mu \parallel_{lie}$. This is in line with existing models of belief distortion that build on the notion of a "split self" with partially conflicting interests.[23] Formally, belief distortion occurs if and only if (i) the subject is aware of the cheating task that will follow at t=1 and (ii) belief distortion advances the subject's material interests, in the sense that,

$$E\left[u(b_{\text{ distorted}})\right] + \mu > 0 \geqslant E\left[u(b_{\text{not distorted}})\right] + \mu \tag{4}$$

where $b_{\text{not distorted}}$ and $b_{\text{distorted}}$ indicate unbiased and biased beliefs.

Timing

The timing of the game is as follows:

- t=0 Belief elicitation task. The task triggers the formation of belief b about majoritarian behavior (in the empirical treatment) or majoritarian normative convictions (in the normative treatment). During the belief formation phase, subjects may engage in self-serving belief distortion (if they are aware of the lying task ahead).
- t=1 Lying/truth-telling dice task. Conditional subjects compute the expected total return from lying and from telling the truth, and choose their action. Payoffs are realized.

Equilibrium

Borrowing the terminology of Bénabou (2015), an intra-personal equilibrium (Perfect Bayesian Equilibrium in the game between date-0 and date-1 selves) for conditional individuals satisfies the following conditions:

[22] Section 6 discusses the possibility that distortion costs may differ depending on the nature of the belief to be distorted.

[23] Section 6 discusses the alternative possibility that belief distortion may be aimed at improving the subject's psychological well-being.

1. At t=1, subjects compute the probabilities of different states of the world by Bayesian updating from their $t = 0$ belief b. They lie if expression (3) holds, and tell the truth otherwise.

2. At t=0, subjects (when aware of the cheating task that will follow) choose to engage in belief distortion iff, taking $t = 1$ behavior as given, condition (4) above holds.

Baseline condition

For benchmark purposes, we first describe what the model predicts for the baseline case, in which the belief elicitation stage $t = 0$ is omitted. This implies that, at $t = 1$, when subjects are introduced with the dice task and have to form beliefs about the state of the world in order to decide how to behave, they are free to direct this process in a self-serving manner, without the "straitjacket" imposed by the the need to be consistent with previously formed beliefs. They will thus choose to distort their beliefs whenever this generates a positive return.

Proposition 0 (Baseline condition): *Provided that the distortion cost is sufficiently low, conditional liars always lie in the baseline condition.*

Cheating Possibility Known (CPK) Condition

We now consider the CPK condition, in which subjects are informed at the outset about the cheating opportunity they will face later in the game. As described in (4), our model predicts that the only case in which belief distortion will *not* occur is when distortion is not necessary to justify, and hence induce, cheating in the dice task. There are thus two possibilities: (1) belief distortion is necessary to induce cheating, in which case (provided that the distortion cost is sufficiently low) beliefs are distorted, or (2) belief distortion is not necessary for cheating. Note that in both cases the final outcome is the same, namely lying in the dice task.

Proposition 1 (CPK condition): *Provided that the belief distortion cost is sufficiently low, conditional liars always lie in both the empirical and the normative treatment.*

Note that this implies that lying in CPK is the same as in the baseline treatment.

Cheating Possibility Unknown (CPU) Condition

Next, we investigate the CPU condition. Clearly enough, in this case subjects have no incentive to distort their beliefs, since they do not anticipate the future lying opportunity. At $t = 0$, they thus process information unbiasedly in both treatments. This implies that, different from the CPK and baseline conditions, in the CPU condition it is possible that conditional liars may end up not cheating at $t = 1$. This happens when the unbiased beliefs elicited at $t = 0$ are such that condition (3) does not hold. The implication is that,

Proposition 2 (CPU condition): *Lying rate in the CPU condition is either,*

(a) the same as in the CPK condition (if there is no belief distortion in CPK), or

(b) lower than in the CPK condition (if there is belief distortion in CPK).

Conditional Liars are Norm Followers

We now add more structure about the underlying motivations of conditional liars. The setup we consider is grounded in the work by Bicchieri (2006). We assume that conditional liars are norm followers, in the sense that they incur a psychological lying cost equal to $\theta > 0$ if the share of individuals who

(a) tell (or would tell) the truth (*empirical requirement)*, and

(b) believe that one should not lie (*normative requirement*)

are majoritarian, and no lying cost otherwise. The psychological cost θ can be seen as arising from the cognitive dissonance generated from lying while knowing that lying is a violation of the norm (as defined by (a) and (b)). Importantly, this cost is contingent on the state of the world being H1, since this is the only state where a majority of individuals satisfy both the empirical (the majority doesn't lie) and normative (the majority thinks that one should not lie) requirements. A conditional subject who believes that the state is H1 with probability p will lie if,

$$\mu - \theta p \rightarrow \frac{\mu}{\theta} > p \tag{5}$$

and will tell the truth otherwise. We assume that $\mu < \theta$, implying that a CL individual who believes the state to be H1 with certainty will prefer to tell the truth (if this was not the case then conditional subjects would always lie independently of their beliefs about the state of the world).

To keep notation light, in what follows we will use the shorthand $p(b)$ to denote $\Pr(\text{H1} \mid b)$, namely the probability that the subject ascribes to state H1 when his $t = 0$ belief is b. As we have seen, in the empirical treatment the choice of b affects beliefs about the state of the world as follows: $p(b_T) > 0$ and $p(b_L) = 0$; similarly, in the normative treatment: $p(b_W) > 0$ and $p(b_R) = 0$. From (4), a low posterior belief p makes it more likely that a conditional subject will lie at $t = 1$. If $p(b) = 0$, he will lie for sure. Given $p(b_L) = 0$ and $p(b_R) = 0$, this implies that the only type of distortion that may take place in the norm model must take the form of conditional subjects convincing themselves that (i) the majority lie (empirical treatment), or (ii) the majority considers lying to be acceptable (normative treatment). Distorting beliefs in the opposite direction (by convincing themselves that the majority doesn't lie or does not approve of lying) would not advance material interests, as it would induce the belief that state H1 is more likely, thus making the subjects less willing to lie at $t = 1$. This leads to,

Proposition 3 (Nature of belief distortion in the norm model): *In equilibrium, belief distortion may only take the form of: (i) inducing belief b_L instead of b_T (empirical treatment), or (ii) inducing belief b_R instead of b_W (normative treatment).*

Note that, while subjects can choose what to believe when engaging in belief distortion, their unbiased beliefs will reflect the true underlying state of the world. In what follows, we focus on the benchmark case where the underlying state is H1, so that, in the absence of belief distortion, a subject would come to the conclusion that the the majority of individuals tell the truth (empirical) or disapprove of lying (normative). In turn, by Proposition 3, this implies that conditional subjects might be tempted to engage in belief distortion, in order to avoid being honest in the subsequent dice task. As will become clear in the Empirical Results section, H1 was actually the true underlying state in our experiment, and is thus the relevant state to consider if we want to test the predictions of the theory with our experimental data.[24]

In the CPK condition, we know by Proposition 1 that conditional subjects always lie. Consider then the CPU condition. In that case, beliefs at $t = 0$ are not distorted, and are thus given by $b = b_T$ in the empirical treatment and $b = b_W$ in the normative treatment (since the underlying state is H1). Lying will occur at $t = 1$ if $p(b_T) < \frac{\mu}{\theta}$ in the empirical treatment, and if $p(b_W) < \frac{\mu}{\theta}$ in the normative treatment. This leads to the following

[24] Predictions obtained in the other possible states of the world are discussed in the Appendix.

proposition,

Proposition 4 (Beliefs and behavior in the norm model): *Suppose that the underlying state is* H1*. If* $p(b_T) > p(b_W)$ *then: (i) Lying in normative CPU (weakly) exceeds lying in empirical CPU; (ii) Because of (i), the incentive to engage in belief distortiom in empirical CPK is (weakly) stronger than in normative CPK. The opposite predictions hold if* $p(b_T) < p(b_W)$.

Hypotheses

This Section describes the testable implications of the theory.

Belief distortion: *We say that belief distortion in the form of x occurs if the share of subjects reporting belief x in CPK is higher than in CPU.*

Our first two hypotheses follow from our basic premise that conditional subjects will, whenever possible, engage in belief distortion when this advances their material interests, by making it easier for them to lie at t=1.

Hypothesis 1: *In the CPK condition, the share of subjects who report the winning number in both the empirical and normative treatment is the same, and is equal to that in the baseline treatment.*

Hypothesis 1 follows from Proposition 0 and Proposition 1. Intuitively, in both the CPK and the baseline treatments, nothing prevents conditional subjects from engaging in belief distortion whenever this generates a positive return.

Hypothesis 2: *If belief distortion occurs, the share of subjects reporting the winning number in CPU is lower than in CPK. If belief distortion does not occur, the share of reports of the winning number in CPU and CPK is the same.*

Hypothesis 2 follows from Proposition 2. Contrary to CPK, in the CPU treatment $t = 0$ beliefs are formed unbiasedly, and may therefore inhibit lying. The only case where CPK and CPU may deliver the same incidence of dishonest behavior is if belief distortion is actually *not needed* for conditional subjects to lie in the dice task.

Hypothesis 3: *If belief distortion occurs, it is in the form of:*

a) "the majority lie"(empirical treatment), or

b) "the majority approves of lying" (normative treatment).

Hypothesis 3 follows from Proposition 3. The next hypothesis deals with comparisons between normative and empirical treatments in the CPK and CPU conditions.

Hypothesis 4: *Suppose that the underlying state is* H1.

a) If $p(b_T) > p(b_W)$*, the following must hold:*

1. *In CPK, if belief distortion occurs in only one treatment, then it must be the empirical treatment.*

2. *In CPU, if the share of subjects reporting the winning number is higher in one treatment, then it must be the normative treatment.*

b) If $p(b_T) < p(b_W)$*: in (i) it must be the normative treatment, while in (ii) it must be the empirical treatment.*

Hypothesis 4 arises from Proposition 4. Recall that $p(b_T)$ is the probability that a subject ascribes to the majority disapproving of lying when the majority tell the truth, while $p(b_W)$ is the probability ascribed to the majority telling the truth when the majority disapprove of lying. The nature of the relationship between $p(b_T)$ and $p(b_W)$ is an empirical question. To address this question, we ran an additional experiment explicitly designed for this purpose, which is described below in the Empirical Results section.

4. Empirical Results

Our analysis varies by the extent of knowledge regarding the upcoming lying opportunity (CPK vs. CPU), as well as the type of belief elicitation (empirical vs. normative). Because the CPK and CPU conditions are the same except for the knowledge about the subsequent dice task, any difference in belief distributions between these two treatments indicates active belief distortion.

We unpack our findings in multiple steps. First, we identify the "true" state of the world as revealed by the data, showing that a norm for honesty as defined in Bicchieri (2006) (state H1) applies to our setup. Second, since Hypothesis 4 is conditional on the relationship between $p(b_T)$ – the belief that the majority disapproves of lying when the majority tell the truth – and $p(b_W)$ – the belief that the majority tells the truth when the majority disapprove of lying – we discuss the additional experiment we designed to this purpose, and spell out how its findings inform Hypothesis 4. Third, we discuss the results from our main experiment, comparing beliefs and lying in the different treatments (normative/empirical) and conditions (CPK/CPU), and relating the findings to our hypotheses.

4.1. True State of the World

We first report the outcomes from a trial session that included questions regarding the appropriateness of lying on the task, and that was used to incentivize belief elicitation in the main experiment based on a total of 100 participants. The data indicate that the majority of individuals (83%) disapproved of lying, and refrained from lying (37% reported the winning number, which suggests a lying rate of approximately 21%). This latter finding is further corroborated by the data from our main experiment, where the number of winning reports across all treatments was 35%. Thus, the true state of the world corresponded to H1, in which the majority of people disapproved of lying and did not lie.

4.2. Experiment on the Relationship between $p(b_T)$ and $p(b_W)$

To test the relationship between $p(b_T)$ and $p(b_W)$, we designed a simple and incentive-compatible experiment.[25] As before, participants were explained the setup of the original experiment and were then randomly allocated to one of two treatment variations. In each treatment, participants received empirical or normative information about a previously-run experiment, namely (1) empirical ("the majority did not lie") or (2) normative ("the majority did not approve of lying") and were then asked to guess whether (i) the majority of participants (dis)approved of lying (after being told 1) or whether (ii) the majority of participants did (not) lie (after being told 2). This approach allows us to elicit normative (posterior) expectations from empirical information and vice versa. The answer to (i) delivers an estimate of $p(b_T)$, namely the probability that a norm of honesty applies when the majority tells the truth, while the answer to (ii) delivers an estimate to $p(b_W)$, namely the probability that a norm of honesty applies when the majority disapproves of lying. Importantly, participants were only presented with one statement and only provided one guess, which was incentivized based on our thruthfully collected data.

Figure 2 illustrates our findings and the results are clear: empirical information strongly affects the normative expectation, but not vice versa. When participants are told that the majority of participants *did not lie*, 77.48% infer that the majority disapprove of lying (Figure 2, left panel). We do not observe the reverse to the same degree (Figure 2, right panel): When participants are told that the *majority disapproves of lying*, only 47.65% infer that the majority is honest. Thus, these results indicate that, in our setup, inference

[25] n=300, 2 conditions in between-subjects design, \$0.50 show-up fee, 99% approval rate, U.S. residents. See Section IV in the Appendix for detailed instructions.

is much stronger in one direction (empirical → normative) than in the other (normative → empirical). In concluding that $p(b_T) > p(b_W)$, we can restate hypothesis 4 as follows:

Hypothesis 4 *(i) In CPK, if belief distortion occurs in only one treatment, then it must be the empirical treatment. (ii) In CPU, if the share of subjects reporting the winning number is higher in one treatment, then it must be the normative treatment.*

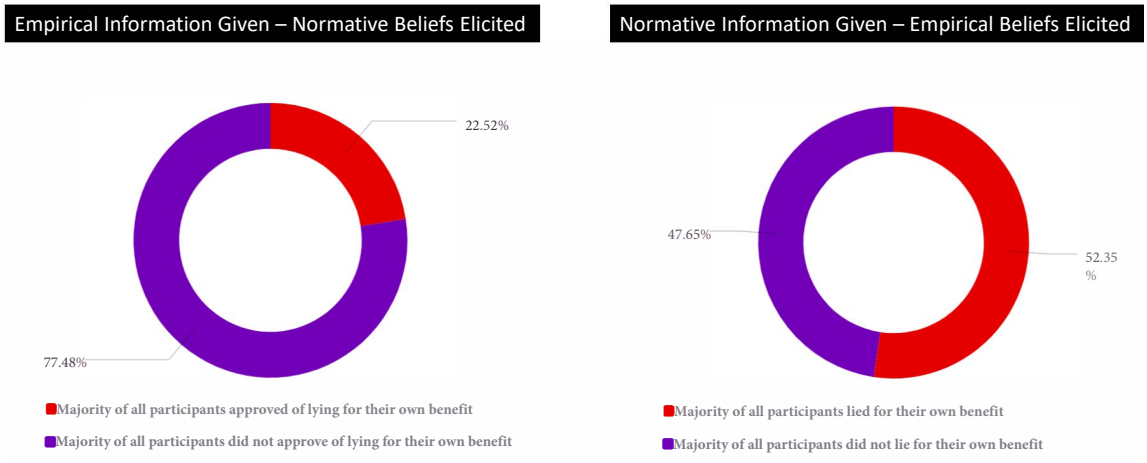

Figure 2: Follow up experiment. Left panel: participants were given empirical information (*Majority of subjects lied*) and were incentivized to guess the majoritarian normative conviction. Right panel: participants were given normative information (*Majority of subjects disapproved of lying*) and were incentivized to guess majoritarian behavior.

4.3. Main Experiment

Figure 3 summarizes our key results. First, in the CPK condition, we see that the share of reported winning numbers is the same in both the empirical and normative treatments (40.5% and 40.2%), and corresponds to what we observed in the baseline treatment (34.7%), which is comparable to the existing literature (Abeler et al., 2019; Gerlach et al., 2019). This confirms our Hypothesis 1. Intuitively, the theory predicts that, if needed, conditional subjects will distort their beliefs in order to lie. As a result, in the CPK and the baseline treatments, they always lie. The only possible case where conditional subjects may end up *not* lying is in the CPU treatment, where beliefs are formed unbiasedly (since subjects are unaware of the lying task ahead). In that case, it is possible that the beliefs they have formed at $t = 0$ might inhibit cheating and, thus, conditional subjects might behave honestly in the dice task.

Second, in line with our motivation, we also investigate belief distortion. To infer whether self-serving belief distortion occurred, we compare beliefs in the CPK and CPU conditions (top part of Figure 3). We start from the empirical treatment. As can be seen in Figure 3, the belief that "the majority lies" increases considerably as we move from CPU to CPK (38.1% versus 62.7%, Equality of Proportions Test (EPT), $p<0.001$). This result indicates that subjects distorted their beliefs when they were alerted about the upcoming opportunity to lie. Moreover, in accordance with Hypothesis 2, belief distortion resulted in a greater incidence of winning reports in CPK compared to CPU (40.5% versus 21.4%, EPT, $p<0.001$), confirming that subjects distorted their beliefs in order to facilitate lying. For both findings, a post-hoc estimation reveals power in excess of 95%.

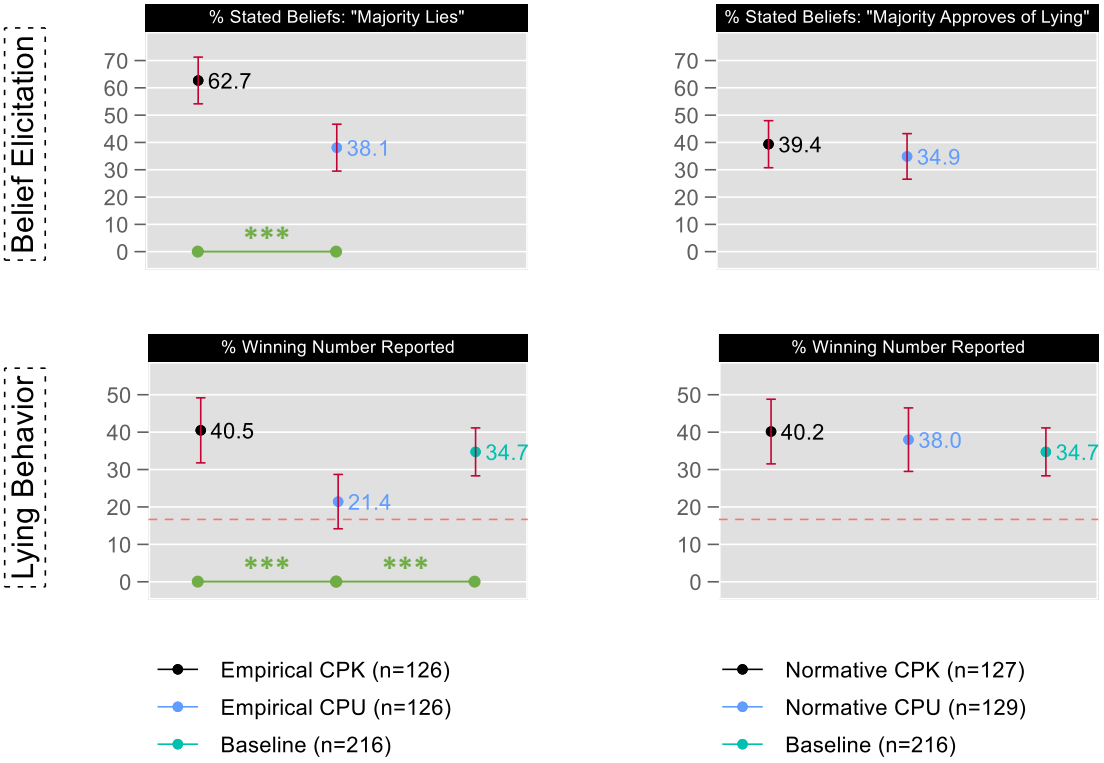

Figure 3: Results from belief elicitation (top panels) and lying frequency (bottom panels) broken down for the Empirical (left panels) and Normative (right panels) conditions and include the same Baseline. Dotted red line illustrates the expected value of 16.67%. Whiskers indicate 95% confidence intervals. Stars indicate significant differences at the conventional levels of *p<0.1, **p<0.05, and ***p<0.01 and are false discovery rate corrected based on the method proposed by Benjamini and Hochberg (1995).

In the normative treatment, on the other hand, beliefs remained statistically indistin-

guishable in CPK and CPU (39.4% and 34.9%), from which we infer that belief distortion did not occur. Again in accordance with Hypothesis 2, winning reports also remained statistically indistinguishable, (40.2% in CPK versus 38.0% in CPU), indicating that the reason why beliefs were not distorted was that this was not needed for conditional subjects to cheat in the subsequent task, since believing that "the majority think lying is not OK" did not inhibit their own lying. We have confidence in these null-findings due to the tight confidence intervals that we observe yielding no economic or theoretically meaningful effect size (based on the previously discussed literature) to fall within its bounds. In contrast, the results obtained in the empirical treatment indicate that, when they believed that the "majority does not lie", conditional subjects chose to behave honestly, and this substantially reduced cheating in the empirical CPU treatment, where, by design, the subjects' elicited beliefs were not distorted.

Turning to Hypothesis 3, the previous discussion has highlighted that, where it occurred (namely, in the empirical treatment), belief distortion followed the pattern predicted by our norm model, namely people convincing themselves that lying is widespread. Further support for the model is provided by the fact that, given that belief distortion occurred only in one treatment, this was the empirical treatment, as predicted by Hypothesis 4. Intuitively, this follows from the observation that, in our setup, inferences are much stronger in one direction (empirical $\rightarrow$ normative) than in the other (normative $\rightarrow$ empirical). In other words, if someone believes that the majority does not lie, then she also needs to acknowledge that a norm of truthtelling is very likely to apply; believing that the majority disapproves of lying is not inconsistent with believing that dishonesty is widespread.

We substantiate our previous results with a Logit regression analysis, examining both stated beliefs and lying frequency (Odds Ratios reported). We ensure the robustness by including a battery of controls (age, gender, risk (SOEP), and Cognitive Reflection Test (CRT) score). The regressions fully confirm the previous results: when comparing our empirical CPU and CPK conditions, both lying frequency and the reported beliefs are significantly different. Conversely, and in line with our previous analysis and theoretical model, neither is true when comparing the normative CPU and CPK conditions. We also provide robustness checks for Hypotheses 1 and 2 with respect to the lying rates between empirical and normative conditions: the former suggests that the lying rates between empirical CPK and normative CPK would be indistinguishable, whereas the latter suggests that lying would be more prevalent in normative CPU compared to empirical CPU. This

is what our results show and are displayed on the right-hand side of Panel B of Table 1.

Table 1: Logit Regression (Odds Ratios) Analysis of Reported Beliefs and Lying Frequency

Panel A *DV: Reported Beliefs*	(1)	(2)	(3)	(4)
Treatment *(Baseline: CPK Condition)*				
Empirical CPU *(1 = Majority Lies)*	0.366*** (0.095)	0.388*** (0.105)		
Normative CPU *(1 = Majority Does Not Approve of Lying)*			0.825 (0.214)	0.779 (0.214)
Controls	No	Yes	No	Yes
Observations	252	252	256	255

Panel B *DV: Lying Behavior*	(1)	(2)	(3)	(4)	Empirical CPK = Normative CPK *(Hypothesis 2)*		Empirical CPU < Normative CPU *(Hypothesis 4)*	
Treatment *(Baseline: CPK Condition)*								
Empirical CPU *(1 = Majority Lies)*	0.401*** (0.114)	0.425*** (0.122)			0.987 (0.253)	1.031 (0.266)	2.246*** (0.637)	2.089** (0.610)
Normative CPU *(1 = Majority Does Not Approve of Lying)*			0.913 (0.234)	0.837 (0.226)				
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	252	252	256	256	253	253	255	255

Pannel A and Panel B: Logit regressions (odds ratios reported) with robust standard errors clustered at the individual level displayed in parentheses. Control variables include Age, Gender, Risk (SOEP), CRT score. Constant estimated but not displayed. Significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

Finally, we also report on conditional lying.[26] Figure 4 indicates that, in the empirical CPK treatment, the percentage of participants reporting the winning number was significantly higher for those who said that most people lie than for those who said the opposite (50.6% vs. 23.4%, p=0.0104). The same holds for empirical CPU (31.3% vs. 15.4%, p=0.0351) but, in line with our model, the *difference* in the propensity to report the winning number for each belief is substantially larger in CPK (50.6%-23.4% = 27.2%) than in CPU (31.3%-15.4% = 15.9%). Intuitively, in the CPK treatment, subjects purposefully distort their beliefs in order to lie in the subsequent task. This strengthens the correlation between lying and holding the belief that the majority of people lie.

[26] Because we run pairwise comparisons, we take into account that such multiple comparisons cause an inflation of type-I-error. To counteract this inflation, we employ the false discovery rate correction by Benjamini and Hochberg (1995), which has superior features compared to the Bonferroni correction.

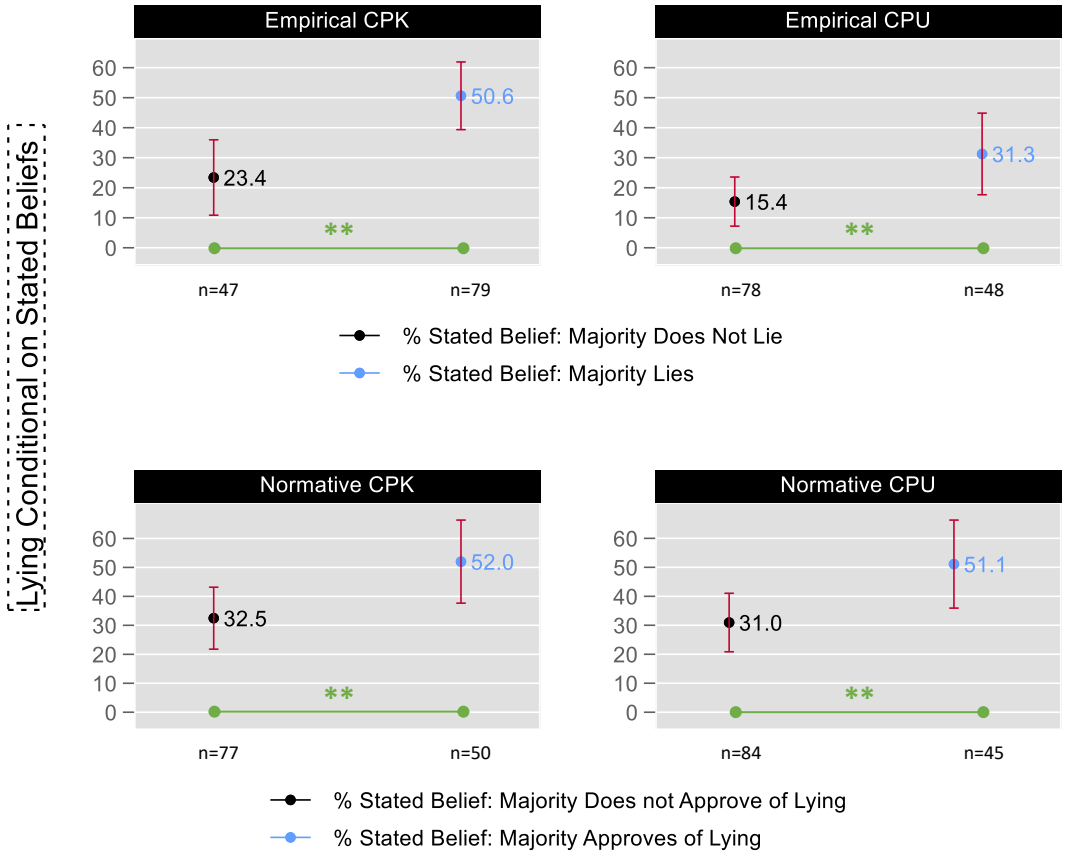

Figure 4: Results from conditional lying behavior for the self-serving conditions (individual is beneficiary of the lie) and are broken down for the Empirical (top panels) and Normative (bottom panels) conditions. Whiskers indicate 95% confidence intervals. Stars indicate significant differences at the conventional levels of *p<0.1, **p<0.05, and ***p<0.01 and are false discovery rate corrected based on the method proposed by Benjamini and Hochberg (1995).

In the normative treatment, we find that, generally speaking, the percentage of participants reporting the winning number was higher for those who said that most people approve of lying than for those who said the opposite.[27] The key statistic for our purposes, however, is again the extent to which the predictive power of beliefs for lying frequency changes as we move from from CPU to CPK. The data show that the difference in the prob-

[27] While our model provides no specific predictions in this respect (since unconditional subjects are treated as a "black box"), it is plausible that this could be due to unconditional truth-tellers being more likely than unconditional liars to believe that most people disapprove of lying.

ability of reporting the winning number when holding different beliefs is the same across the two conditions (normative CPK: 52.0%-32.5% = 19.5%, normative CPU: 51.1%-31.0% = 20%). This fits our theoretical account since, as we have seen, in the normative treatment, conditional subjects did not engage in belief distortion. As a result, there is no reason to expect different correlations between beliefs and lying frequency in CPK and CPU.[28]

5. Discussion

Following our theoretical and empirical examination, we deem it important to provide the reader with a comprehensive discussion of extensions of our model and alternative interpretations of our findings. We will use both empirical and theoretical arguments to strengthen the core of our findings and position our contribution within the existing economic research. We address the following possibilities: (i) belief distortion costs depend on the nature of the belief to be distorted, (ii) belief distortion is motivated by psychological (rather than material) considerations, (iii) the relevant dichotomy is not majority/minority (iv) subjects use stated beliefs as signaling devices. We also discuss several alternative motivations for conditional liars: (i) cognitive dissonance and Rabin's (1994) theory of moral dissonance (ii) reputation for honesty and related image concerns, (iii) pure conformity.

Differing Costs of Belief Distortion

Our stylized model assumes that the cost of distorting beliefs is constant (and equal to zero for simplicity). However, a more general model could assume that the cost of distortion depends on the nature of the belief being distorted. This opens up the possibility that our experimental finding of belief distortion not occurring in the normative treatment may be due to the fact that normative expectations are harder to distort than empirical expectations. Intuitively, this might be the case if the ex-ante probability that the majority considers lying acceptable is smaller than the ex-ante probability that the majority might actually lie. This would happen in the presence of a well-established norm – e.g. fairness or reciprocity – where it is hard to believe that a majority would approve of unfairness or lack of reciprocity. Formally, suppose that the cost of self-servingly inducing belief b_i, $i = a, m$ by means of ad hoc information processing is a decreasing function of the prior probability that i may actually occur. In our setup, the ex-ante probability that $a = L$ is

[28] All of our results are fully robust to a regression analysis that mimics our previous exercise (with and without controls). The results are available upon request.

$1-q$, while the ex-ante probability that $m = R$ is $q(1-g) + (1-q)(1-r)$. If the latter is smaller than the former, then the cost of inducing belief b_R instead of b_W will be larger than the cost of inducing b_L instead of b_T. Intuitively, if it is ex-ante very unlikely that in any given situation the majority of individuals might consider lying acceptable, then it seems plausible that subjects might find it harder to find arguments to convince themselves that this is the case when it actually is not.

Although this is a potentially interesting extension of our model, we do not think that our experimental findings in the normative treatment should be taken to indicate that normative expectations are harder to distort in our setup. The key observation here is that the incidence of lying in the normative treatment (whether in CPK, CPU or the baseline condition) is *the same* as in empirical CPK (and higher than empirical CPU). In other words, in the normative treatment subjects lie as much as when engaging in belief distortion in the empirical treatment. As discussed, our interpretation is that distorting normative expectations is not needed to induce lying. Hence, in the normative treatment, belief distortion will not occur even if the cost of distorting normative beliefs is negligible (as in our main model). Our theoretical analysis explains why this is the case.

Belief Distortion is Motivated by Psychological Considerations

Our model assumes that belief distortion is entirely motivated by material payoff: at $t = 0$, a subject distorts his beliefs *only if* this is necessary to induce him to cheat at $t = 1$. This rules our an alternative hypothesis, namely that a subject who would lie *anyway* may engage in belief distortion to feel less guilty about lying.

In our experiment, this would generate a sensible difference between CPK and CPU in terms of beliefs, but no difference in terms of behavior. However, this is not the pattern we observe. In our data, CPK and CPU either deliver the same beliefs and the same behavior (normative treatment), or differ in both beliefs and behavior (empirical treatment). In fact, in the empirical treatment, the difference between the share of subjects who believe that the majority lie in CPK and CPU (62.7-38.1=24.6) is almost identical to the difference in reported winning numbers between the two conditions (40.5-21.4=19.1). This suggests that the overwhelming majority of those who distort their beliefs in empirical CPK do so to change their behavior in the lying task (a *strategic* motive).

Relevant Dichotomy is not Majority/Minority

Recall that in our model, conditional liars prefer not lying if they believe that a) most people do not lie (empirical expectation) and b) most people disapprove of lying

(normative expectation) (Bicchieri, 2006). Although the partition between majoritarian and minoritarian behavior and beliefs is natural, it is conceivable that the relevant threshold might in fact differ from 50% and, if true, challenge our empirical analysis. Suppose that conditional liars suffer a disutility from lying if they believe that at least 75% of people do not lie and disapprove of lying. In this case, belief distortion aimed at facilitating lying in the dice task could take the form of CL subjects convincing themselves in the CPK condition that the share of truthtellers is, say, 60% rather than 80%. Since both these shares are majoritarian, this distortion would not be picked up by our belief elicitation task (which focuses on the majority/minority dichotomy).

The resulting empirical pattern would then take the form of observing higher lying rates in CPK compared to CPU (reflecting the fact that, in CPK, belief distortion did take place), while at the same time observing no difference in elicited beliefs. However, this is not what we see in our data. In the empirical treatment, higher lying rates in CPK correspond to a higher share of subjects believing that the majority lies. In the normative treatment, lying rates are the same in CPK and CPU, and this is matched by correspondingly similar elicited beliefs in both treatments.

Stated Beliefs as a Signaling Device

Our analysis assumes that the subjects' elicited beliefs reflect their true beliefs, distorted or not. However, our previous discussion about self-image concerns raises the possibility (at least in principle) that subjects may strategically select their stated beliefs with the aim of producing a positive impression in an external observer.[29] For instance, it is conceivable that if a subject who reports the winning number (thus raising the suspicion that she may be cheating) also reports a belief that the majority lie or that the majority considers lying acceptable, this reported belief may be seen by an observer as a valid excuse for (possible) cheating behavior. Modeling this scenario requires a careful explanation of why the stated beliefs may help improve the subject's image.[30]

However, it is unlikely that this might have occurred in our experiment. Again, the key observation here comes from the normative treatment, where the subjects' stated beliefs are the same in CPK and CPU conditions. This casts doubt on the possibility that the stated beliefs are used strategically by our subjects. Intuitively, if this were the case, then in

[29] This is documented by Andreoni and Sanchez (2019) within the context of a trust game.

[30] The notion that individuals may make use of excuses in a strategic manner, in order to order to influence the image they project is formally modeled by Bénabou et al. (2018b).

the normative treatment we would expect the share of subjects reporting that they believe that the majority finds lying to be acceptable to increase in CPK (where subjects are aware of the lying opportunity ahead) compared to CPU (where they are not aware of it). However, this is not what we observe. To explain this evidence, a theory of stated beliefs as signaling devices should therefore explain why the subjects' incentives to strategically distort reported beliefs might differ between empirical and normative treatments.

Conditional liars are not concerned with norm-following

We now discuss possible alternative motivations for Conditional Liars and related predictions in the context of our experiment.

Generic Cognitive Dissonance and Moral Dissonance as per Rabin (1994)

In his classic monograph, Festinger (1962) defines cognitive dissonance as the mental discomfort (psychological stress) experienced by a person who holds contradictory beliefs. To reduce this dissonance, individuals may engage in self-serving belief distortion. Our model can be seen as a special case of this general principle, in the sense that CL subjects engage in belief distortion in order to avoid the psychological cost θ, incurred when subjects lie while simultaneously believing that a norm of honesty applies.

This raises the question whether our findings could be explained by a more general model where, for CL subjects, cognitive dissonance costs arise whenever their behavior conflicts with the (empirical or normative) expectations that they hold about other individuals. Our results in the normative treatment show that this is not the case: subjects do not feel the need to engage in belief distortion, and the belief that "the majority disapproves of lying" does not deter lying. This rules out that CL subjects experience a (non-negligible) psychological discomfort when lying while holding that belief.

Our findings in the normative treatment also rule out that the Rabin (1994) theory of moral dissonance might apply in this setup. In Rabin's model, people suffer a disutility (dissonance cost) when engaging in activities they believe to be immoral – a phenomenon he calls "moral dissonance."[31] The theory assumes that if society considers a behavior (say, lying) immoral, this makes it harder for a liar to avoid incurring the dissonance cost. In our setup, this implies that, in the normative treatment, CL subjects will want to convince themselves that the majority approve of lying in order to facilitate lying in the subsequent dice task. Belief distortion may also occur in the empirical treatment, but only to the extent

[31] Barkan et al. (2012) use the term "ethical dissonance".

to which behavior informs what the majority deems to be morally acceptable. Hence, if belief distortion occurs in only one treatment, the theory of moral dissonance predicts that it should be the normative treatment. This is in fact the opposite of what we observe.

Reputation for Honesty (With no Under-Reporting) and Other Image Models

Recent contributions to the lying literature (such as Abeler et al., 2019; Gneezy et al., 2018a) have shown that reputation and image concerns play an important role in explaining lying behavior. The desire to appear honest (or to signal high lying costs) rationalizes a number of findings that cannot be explained by other models, such as that, when lies come in different "sizes," a share of those who choose to lie typically avoids the maximal report – choosing "smaller" lies instead.[32]

We argue that, while image has been shown to be an important driver of lying decisions, standard image models *alone* are unlikely to predict our experimental findings. It is worth stressing that our experiment was conducted online with no direct human interaction, an environment where image concerns have been shown to be minimal (see, e.g., Cohn et al., 2018; Bolton et al., 2019; Dimant et al., 2019). In that sense, we expect that, in our setup, these types of concerns played a smaller role than in other environments. We start by presenting a setup that is inspired by the model of social image by Gneezy et al. (2018a) – see also Khalmetski and Sliwka (2019); Dufwenberg and Dufwenberg (2018). To illustrate the key effects, we will supplement the discussion with some formal analysis.

Suppose that conditional subjects derive utility from their *social image*, which is defined (as in Gneezy et al. 2018a; Abeler et al. 2019 and Khalmetski and Sliwka 2019) as the probability that their report is interpreted as being honest by an outside observer. The underlying idea is that, for image conscious agents, being viewed as honest is an intrinsically valued part of their social identity. The utility of a conditional type is given by,

$$\begin{cases} \delta \text{ if he reports the losing number} \\ \mu + \delta\rho \text{ if he reports the winning number} \end{cases} \tag{6}$$

where $\delta > 0$ is the weight given to social image and $\rho \equiv \Pr(\text{honest report} \mid \text{report} = \text{winning \#})$ is the social image that derives from reporting the winning number, and

[32] Consider, e.g., the experiment by Gneezy et al. (2018a) where participants draw a number from 1 - 10, and payment equals the number reported. While reporting a 10 generates the largest monetary return, a significant share of subjects choose to lie by reporting 8 or 9. See also Abeler et al. (2014).

corresponds to the assessment by an external observer of the likelihood that the report is true. The social image from reporting a losing number is normalized to 1. This rules out under-reporting since, even if an observer believes that a subject who reports the losing number had in fact drawn the winning number, it is not penalized, in the sense that it does not lower the subject's social image.[33] In what follows we assume $\delta > \mu$, implying that a conditional agent will not report the winning number if the social image associated with it is sufficiently low. A subject who draws the losing number will lie and dishonestly report the winning number if,

$$\rho > 1 - \frac{\mu}{\delta}$$

and will report truthfully otherwise. We follow Bénabou and Tirole (2011) and assume that, when assessing the likelihood that a report may or may not be truthful, the external observer knows the underlying state. This implies that the social image from reporting the winning number is derived from Bayesian updating from the true state (as well as from the equilibrium behavior of CL types). Denoting as ρ^S the social image from reporting the winning number in state S, in the Appendix we prove that, in equilibrium,

Lemma 1: $\min\left\{\rho^{H1}, \rho^{H2}\right\} > \max\left\{\rho^{L1}, \rho^{L2}\right\}$.

Proof: in Appendix.

Intuitively, when there are many liars misreporting the winning number (state L1 or L2), the social image from reporting the winning number is low, since it is likely to be a lie. Conversely, when it is known that majority of people tell the truth (state H1 or H2), a winning number report is likely to be truthful, and thus yields a higher social image. Image conscious agents are thus more inclined to lie in the latter case than in the former.

Consider now belief distortion. We start by analyzing the CPK condition. Recall that belief distortion will occur if it induces the subject to lie in a situation where, in the absence of distortion, she wouldn't lie. Consider the empirical treatment. Clearly enough, Pr(H1 or H2 | b_T) = 1 and, similarly, Pr(L1 or L2 | b_L) = 1. Given Lemma 1, this implies that, at t=1, the returns from lying for a conditional type when her belief is $b = b_T$ are higher than when $b = b_L$. Hence, in contrast with the norm-based model, in

[33] In contrast, if a subject is thought to be reporting the winning number in spite of drawing the losing number in order to obtain a financial gain, this negatively affects his social image. The absence of under-reporting is in line with available evidence. For instance, in the experiment by Gneezy et al. (2018a) (where, in one of the treatments, the experimenter could ex-post verify the number observed by each subject) only 1 participant out of 602 chose to under-report.

the social image model the only type of belief distortion that may occur at t=0 takes the form of convincing oneself that the majority doesn't lie. Intuitively, when most agents tell the truth, an observer will interpret a winning report as likely to be honest. Instead, in situations where most agents lie, a winning number report is interpreted as likely to be dishonest, and thus results in a low social image. The incentive for an image-conscious individual to report the winning number when he believes that most individuals lie is therefore lower than when he believes that most agents tell the truth.

We now turn to the normative treatment. We prove in the Appendix that, in equilibrium, the following holds:

Lemma 2: *If $g > r$, the only form of belief distortion that may occur in the normative treatment takes the form of inducing b_W instead of b_R .*

Proof: in Appendix.

Although the relationship between g and r is, in principle, an empirical question, we conjecture that $g > r$, and accordingly assume this to be the case in what follows.[34]

Proposition 5: *In equilibrium, belief distortion may only take the form of: (i) inducing belief b_T instead of b_L (empirical treatment), or (ii) (under the assumption that $g > r$) inducing belief b_W instead of b_R (normative treatment).*

We focus on the case where the underlying state is H1, i.e. the majority tell the truth and believe lying to be wrong (since this is the state that turned out to apply in our experiment). From Proposition 5, in this case image motivated conditional subjects do not need to engage in belief distortion in order to lie, implying that,

Proposition 6: *Suppose that the underlying state is* H1*. Then, (i) belief distortion does not occur, and (ii) CL subjects lie in all treatments: empirical CPK, normative CPK, empirical CPU and normative CPU.*

This shows that a model à la Gneezy et al. (2018a), where conditional subjects are motivated by the desire to appear honest (and where underreporting is ruled out), would deliver qualitatively different predictions than our norm-based model.[35] The predictions of Propositions 5 and 6 are are not borne out in our data, which suggests that our data cannot be explained by this type of image concerns.

[34] Recall that g is the probability that Unconditionally Honest agents believe that lying is wrong, while r is the equivalent probability for Unconditional Liars.

[35] This analysis considers a stylized model, but the results hold generally, as shown by Abeler et al. (2019).

There are other image based models, however, that could yield predictions that are consistent with our findings. Consider a model along the lines of Bénabou and Tirole (2006b, 2011) where, rather than depending on the probability that a subject's report is honest/dishonest, social image depends on an outside observer's beliefs about the subject's *lying costs* (see also Adriani and Sonderegger, 2019). This implies, for instance, that if in equilibrium types with relatively low lying costs tell the truth by reporting a losing number (as may occur for instance if these inherently "dishonest" types are very concerned with their reputation), truthtelling will yield a lower social image than if it only involved high-lying-costs subjects. Under appropriate assumptions about the underlying type distributions, a model of this kind could predict that, in order to lie more easily, subjects should convince themselves that lying is widespread, consistent with our findings. At the same time, under different assumptions (which depend on features difficult to empirically verify), this model could make the opposite empirical predictions. Thus, the "reputation for lying costs" model is harder to falsify than the norm-based model we proposed.[36]

Pure Conformity

Finally, we note that our experimental results are also consistent with a pure-conformity explanation of lying behavior, in which conditional subjects simply care about conforming with what they believe the majority does, without concerning themselves with normative considerations. In this light, lying or honest behavior are simply dictated by the dominant convention, similar to left- or right-hand driving (Young, 1996; Bicchieri, 2006).

Although theoretically possible, we think that this explanation is unlikely in our setting. In most societies, lying behavior is the object of normative prescriptions, with strong moral connotations, as exemplified by the "thou shalt not lie" biblical prescription or Kant's categorical imperative to never lie. This makes it implausible that people may come to see lying as morally neutral and purely convention-driven. At the same time, although lying is generally disapproved of, there is also a shared understanding that, in some cases, lying might be admissible – obvious examples include lying to save lives or lying to confound an enemy. More generally, in unfamiliar and less clear-cut environments, there may be some uncertainty about the extent to which lying might be considered reprehensible by others.

[36] The same applies to a reputation for honesty model where under-reporting occurs with positive probability in equilibrium, see Abeler et al. (2019).

6. Concluding Remarks

Norm violation often provides a material benefit to the transgressor. If conditional norm-followers can convince themselves that a norm does not apply to a situation, or is not presently followed, then they have reason to disregard it. Often it is not fully clear what other people do or have done in the same situation, or whether they approve of specific behaviors. Uncertainty about what the norm is or whether it is presently followed can be solved in a self-serving manner. For example, evidence consistent with the desired behavior often receives preferential treatment (Kunda, 1990). Or, if one must decide what to believe to be true about a norm, one may give more weight to selfish motivations since there is uncertainty as to which belief is true (Schweitzer and Hsee, 2002).

Our experimental design varies both the nature of belief elicitation (empirical: what others do, versus normative: what others think should be done) and the timing at which participants learn about their opportunity to lie. In the "Cheating Possibility Known" (CPK) condition, participants know prior to the belief elicitation that they will shortly be faced with the dice task, while in the "Cheating Possibility Unknown" (CPU) condition, participants learn about the dice task only after the belief elicitation has taken place. Our hypothesis is that, if individuals are aware of the forthcoming lying opportunity at the time they form their beliefs, they may engage in self-serving belief manipulation to facilitate lying in the subsequent task. We combine empirical evidence with a theoretical model of belief distortion based on the work of Bénabou and Tirole (2006a, 2011, 2016) and connected to the model of social norms in the spirit of Bicchieri (2006), from which we derive clear and testable predictions.

Our experiment yields a number of interesting results consistent with our theory, and which allow us to rule out a number of alternative mechanisms. These include the notion that people may use avowed beliefs as signals, that norm-related belief distortion may be motivated by psychological rather than *strategic* considerations (e.g., aimed at changing one's own subsequent behavior), and that the purpose of norm-related belief distortion may be to mitigate "moral dissonance". In the empirical treatment, we find convincing evidence for belief distortion: individuals choose to believe that most people lie because this facilitates their own lying. This, in turn, leads to higher cheating rates overall, supporting the notion that the reason for individuals to distort their beliefs is to enhance their material payoff by cheating. Conversely, when belief elicitation concerns the normative domain (what others approve of), we do not observe belief distortion, and beliefs as well

as actual lying rates remain statistically invariant between CPK and CPU. As argued (and conclusively shown in a follow-up study), this result is driven by the fact that normative and empirical information vary in their signaling content: words are cheap but actions are costly– a difference that influences the decision to distort one's beliefs and lie.

The data also indicate that, once people form a belief, it tends to stick even when it would be profitable to change it. In our experiment, subjects with previously formed unbiased empirical beliefs were less likely to lie in the subsequent dice task. This result supports interventions aimed at shaping initial individual beliefs on matters of common interest. Once crystallized, these beliefs are harder to distort in a self-serving way, which in turn inhibits deviant behavior.

Our findings can influence norm-nudging by showing that, in a benchmark setting without explicit norm information, people may distort their beliefs about norms in a self-serving way. We have characterized the nature of the distortion process, and when it may occur. Future research should deepen our understanding of the different impact of empirical versus normative information and whether it may be optimal to combine them. Recent work has shown that people may exhibit self-serving biases when *updating* their beliefs, even when the information they have received is unambiguous and objective. An example are beliefs about own ability (Zimmermann, 2019).[37] Is this also true for beliefs about norms? Does the fact that people may choose their initial norm-related beliefs strategically mean that they are also less likely to take in new information (for instance provided as part of a nudge intervention) when it disagrees with their (strategically distorted) initial beliefs? These questions are important to develop a full understanding of the impact of norm nudges. We believe that our findings represent an important first step in that direction.

[37] Schwardmann and van der Weele (2019) argue that such self-deception is motivated by the desire to more effectively persuade or deceive others. More generally, Ambuehl and Li (2018) point out that subjects often underreact to increase the information content of a signal, thus undervaluing high-quality information.

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Appendix

I. Theoretical Appendix

I.1 Predictions in States of the World Other Than H1

In the main text we focused on deriving empirical predictions for state H1, which, as discussed, corresponds to the true underlying state in our setup. Here, for completeness, we include the predictions of our theoretical model in the other possible states of the world. For brevity, we focus on the predictions for the norm model. The predictions for the image model can be obtained in an analogous fashion. The first observation is that Hypotheses 1, 2 and 3 are independent of of the underlying state of the world and thus continue to hold straightforwardly. Consider then Hypothesis 4.

State H2

When this is the underlying state, belief manipulation will never occur in the normative treatment, while in the empirical treatment it may occur. Hypothesis 4 changes as follows: Predictions a) (i) and (ii) now hold independently of the nature of the relationship between $p(b_T)$ and $p(b_W)$.

State L1

When this is the underlying state, belief manipulation will never occur in the empirical treatment, while in the normative treatment it may occur. Hypothesis 4 changes as follows: Predictions b) (i) and (ii) now hold independently of the nature of the relationship between $p(b_T)$ and $p(b_W)$.

State L2

When this is the underlying state, belief manipulation will never occur in either the empirical or the normative treatment. The share of subjects who report the winning number is the same in both treatments (empirical/normative) and in both conditions (CPK/CPU).

I.2 Robustness: Monetary incentives at the belief elicitation stage

We now show how, in a slightly modified version of our main setup, CN subjects may engage in belief manipulation also when offered explicit monetary incentives at the belief elicitation stage, and even when these incentives are equal the monetary return from reporting a winning number, namely μ.

Consider a setup in which, with small but positive probability, $b_{\text{no manip}}$ does not reflect the true underlying state of the world. For instance, it is possible that one's own past

experiences might be somewhat biased, and may therefore lead a subject to draw incorrect inferences, even in the absence of belief manipulation. Formally, this implies that, for some $\pi > 1/2$, the following holds.

- When $a = T$ (resp. L), in the empirical treatment: $b_{\text{no manip}} = b_T$ (resp., b_L) with probability π, and $b_{\text{no manip}} = b_L$ (resp., b_T) with probability $1 - \pi$.
- When $m = W$ (resp. R), in the normative treatment: $b_{\text{no manip}} = b_W$ (resp., b_R) with probability π, and $b_{\text{no manip}} = b_R$ (resp., b_W) with probability $1 - \pi$.

Note that the model examined in the main text is a special case of this more general model, in which $\pi = 1$. It is straightforward to see that Bayesian updating then implies $\Pr(a \mid b_{\text{no manip}} = b_a) < 1$ and $\Pr(m \mid b_{\text{no manip}} = b_m) < 1$. In other words, even if the subject does not manipulate beliefs, the subject is not certain of the underlying majoritarian action or majoritarian moral conviction.

Consider now the choice to manipulate beliefs at $t = 0$. Suppose that, if manipulation occurs, the subject will lie at $t = 1$, while if manipulation does not occur, the subject will not lie at $t = 1$. It is then clear that, at $t = 0$, manipulation is in the subject's material interests. This is because, if the subject does not manipulate, the subject will earn μ with probability less than 1, as explained above. Conversely, if the subject manipulates (and thus reports the winning number with certainty at t=1), the subject will earn μ for sure.

I.3 Reputation for Honesty: Proofs of Lemmata 1 and 2

Proof of lemma 1: Let $\eta \in [0, 1]$ denote the probability that a type CL who draws a losing number dishonestly reports the winning number. By Bayesian updating, $\rho = \frac{\frac{1}{6}}{\frac{1}{6}+\frac{5}{6}[\alpha_{UL}+\eta(1-h-l)]}$, decreasing in η. Substituting for $\eta = 0$ (resp., $\eta = 1$) in this expression, we obtain an upper (lower) bound for ρ for a given value of α_{UL}, obtaining $\rho \in \left[\frac{1}{1+5[\alpha_{UL}+1-h-l]}, \frac{1}{1+5\alpha_{UL}}\right]$. As a result, $\min\{\rho^{\text{H1}}, \rho^{\text{H2}}\} \geq \frac{1}{1+5(1-h)}$ (since $\alpha_{UL} = l$ in those states), while $\max\{\rho^{\text{L1}}, \rho^{\text{L2}}\} \leq \frac{1}{1+5h}$ (since $\alpha_{UL} = h$). Since $h > 1/2$, $\frac{1}{1+5(1-h)} > \frac{1}{1+5h}$ and hence, $\min\{\rho^{\text{H1}}, \rho^{\text{H2}}\} > \max\{\rho^{\text{L1}}, \rho^{\text{L2}}\}$. □

Proof of lemma 2. We prove the lemma by showing that the opposite form of belief manipulation cannot emerge in equilibrium, as it would generate a contradiction. To this purpose, first note that, if $g > r$, then $\Pr(\text{H1}|\ b_W) > \Pr(\text{H2}|\ b_R)$. Suppose now that $E(\rho \mid b_R) > 1 - \frac{\mu}{\delta} > E(\rho \mid b_W)$, implying that CL subjects lie at $t = 1$ when $b = b_R$ but

not when $b = b_W$. Then, $\rho^{\text{H1}} = \frac{1}{1+5l}$ and $\rho^{\text{H2}} = \frac{1}{1+5(1-h)} < \rho^{\text{H1}}$, and similarly, $\rho^{\text{L1}} = \frac{1}{1+5h}$ and $\rho^{\text{L2}} = \frac{1}{1+5(1-l)} < \rho^{\text{L1}}$. In turn, this implies that

$$\Pr(\text{H1} \mid b_W)\rho^{\text{H1}} + (1 - \Pr(\text{H1} \mid b_W))\,\rho^{\text{L1}} > \Pr(\text{H2} \mid b_W)\rho^{\text{H2}} + (1 - \Pr(\text{H2} \mid b_W))\,\rho^{\text{L2}}$$

and, hence, $E(\rho \mid b_W) > \text{E}(\rho \mid b_R)$, a contradiction. A similar argument rules out that $E(\rho \mid b_R) > 1 - \frac{\mu}{\delta} = E(\rho \mid b_W)$. The only possible remaining cases are: (i) both $E(\rho \mid b_R)$ and $E(\rho \mid b_W)$ are $>1 - \frac{\mu}{\delta}$, (ii) both $E(\rho \mid b_R)$ and $E(\rho \mid b_W)$ are $<1 - \frac{\mu}{\delta}$, (iii) $E(\rho \mid b_W) > 1 - \frac{\mu}{\delta} \geq E(\rho \mid b_R)$. In cases (i) and (ii), the subject does not benefit from belief manipulation in the normative treatment, and thus does not engage in it. In case (iii), CL subjects lie at $t = 1$ when $b = b_W$ but not when $b = b_R$. In this case, belief manipulation may emerge, taking the form of inducing belief b_W instead of b_R. □

I.4 Other-Regarding Condition: Toy Model

Suppose that the beneficiary of the lie is a charity rather than the subject as in the condition analyzed in the main text. If a CL subject lies, he may incur a psychological cost but also experiences a warm glow, denoted by $\gamma\mu \geq 0$, where μ is the payment received by the charity and $0 \leq \gamma \leq 1$ is a measure of altruistic concern towards the charity. Note that the lie now generates no direct monetary return for the agent. Two observations are in order. First, recall that belief manipulation in our model is motivated by personal monetary returns from lying at $t = 1$. Since the direct monetary return from lying is now zero, it follows that the agent will never choose to distort his beliefs at $t = 0$.[38] Second, suppose that the underlying state is H1.[39] Optimal behavior at $t = 1$ is given by:

$$\begin{cases} a = L \text{ if } p(b) < \frac{\gamma\mu}{\theta} \\ a = T \text{ if } p(b) \geq \frac{\gamma\mu}{\theta} \end{cases} \tag{7}$$

Compared with its equivalent in the self-serving condition, the requirement for lying to occur is now more stringent, since μ is multiplied by $\gamma \leq 1$. This implies,

[38] This argument is strengthened if we explicitly account for the monetary incentives present in the belief elicitation task, since in that case belief manipulation results in a monetary (opportunity) cost at $t = 0$.

[39] We focus on H1 since this is the state which turned out to apply in the other-regarding condition (as well as the main treatment). Note however that, differently from the main body, in the other regarding case it could also be possible that a norm for lying might emerge (Levine and Schweitzer, 2015). Our theoretical setup focuses on the existence (or not) of a norm for honesty, but it could be easily adapted to lying norms.

Proposition (Other-Regarding Condition):

a *Belief manipulation never occurs in the other regarding condition, implying that CPK and CPU conditions yield the same amount of lying.*

b *If the underlying state is H1: comparing across treatments, if* $p(b_T) > p(b_W)$ *then lying in the normative treatment (weakly) exceeds lying in the empirical treatment, while the opposite holds if* $p(b_T) < p(b_W)$.

c *If the underlying state is H1, within each treatment (empirical/normative), lying in the self-serving condition (weakly) exceeds lying in the other regarding condition.*

II. Other-Regarding (Charity) Condition: Empirical Analysis

We now turn to the empirical analysis analysis for the other-regarding condition, in which the beneficiary of the lie is a charity. For these treatments, a total of 724 have been collected and are analyzed below (a detailed breakdown is provided at the bottom of the figures below). Consistent with our theoretical predictions, the observed behavior is in stark contrast to our results from the main experiment, in which the beneficiary of the lie is the participant: beliefs, lying rates, and conditional lying rates and we do not observe any significant belief distortion, neither in the empirical treatment (45.7% vs. 51.6%, Equality of Proportions Test (EPT), p=0.3462) nor in the normative treatment (37.6% vs. 44.4%, EPT, p=0.2785). As expected, the absence of belief distortion also leads to an absence in significant changes of lying frequency in all treatments (all p-values above 0.3).[40]

[40] Noteworthy, we observe low overall levels of lying in the purely other-regarding conditions. We attribute this to both the absence of self-serving motives and the induced uncertainty about the appropriateness of altruistic behavior, which corroborates existing literature (Di Tella et al., 2015; Exley, 2015).

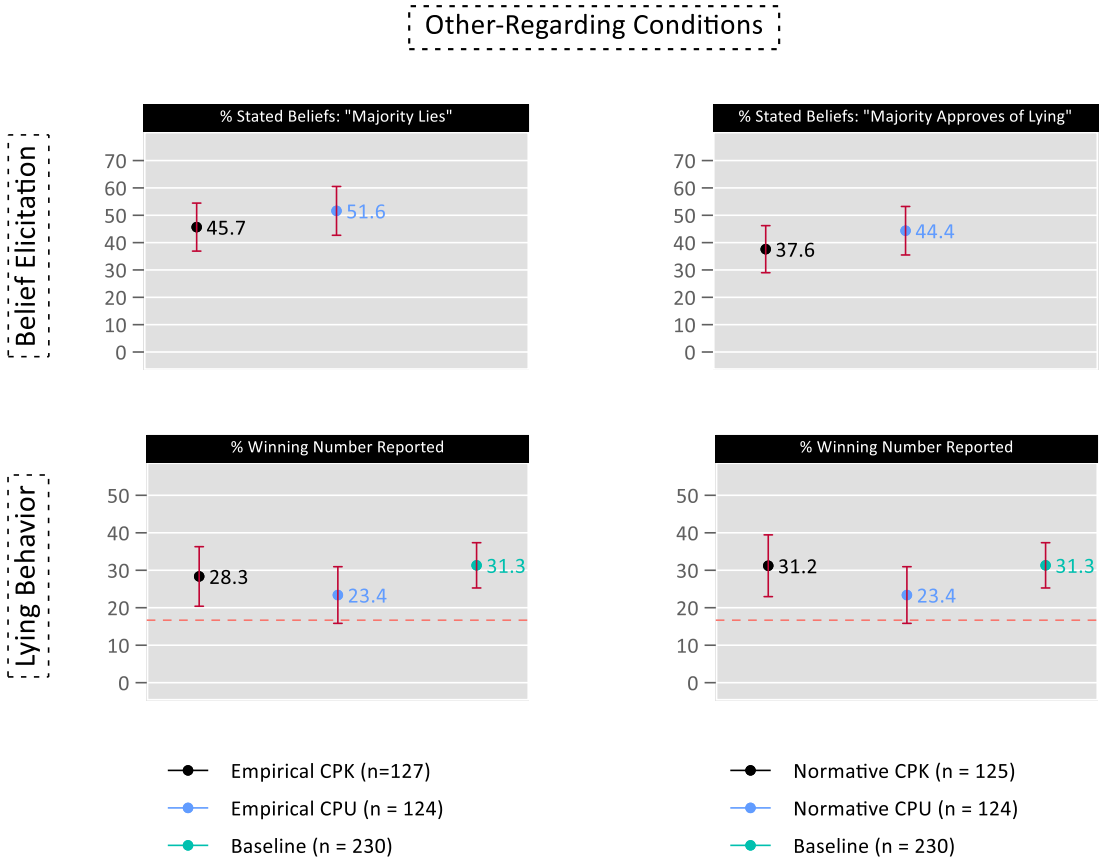

Figure A.1: Results from belief elicitation (top panels) and lying frequency (bottom panels) broken down for the Empirical (left panels) and Normative (right panels) conditions and include the same Baseline. Dotted red line illustrates the expected value of 16.67%. Whiskers indicate 95% confidence intervals. Stars indicate significant differences at the conventional levels of *p<0.1, **p<0.05, and ***p<0.01 and are false discovery rate corrected based on the method proposed by Benjamini and Hochberg (1995).

We substantiate our previous results through the lens of a Logit regression analysis, examining both stated beliefs and lying frequency. We ensure the robustness by including a battery of controls (age, gender, risk (SOEP), and CRT score). The regressions fully confirm the previous results and presented in Table A.1.

Table A.1: Logit Regression (Odds Ratios) Analysis of Reported Beliefs and Lying Frequency

Panel A *DV: Reported Beliefs*	(1)	(2)	(3)	(4)
Treatment *(Baseline: CPK Condition)*				
Empirical CPU *(1 = Majority Lies)*	1.269 (0.322)	1.190 (0.311)		
Normative CPU *(1 = Majority Does Not Approve of Lying)*			1.323 (0.343)	1.544 (0.424)
Controls	No	Yes	No	Yes
Observations	251	251	249	249

Panel B *DV: Lying Behavior*	(1)	(2)	(3)	(4)	Empirical CPK = Normative CPK *(Hypothesis 2)*		Empirical CPU < Normative CPU *(Hypothesis 4)*	
Treatment *(Baseline: CPK Condition)*								
Empirical CPU *(1 = Majority Lies)*	0.772 (0.224)	0.802 (0.249)			1.146 (0.317)	1.153 (0.328)	1.000 (0.301)	1.010 (0.305)
Normative CPU *(1 = Majority Does Not Approve of Lying)*			0.673 (0.193)	0.616 (0.188)				
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	251	251	249	249	252	252	248	248

Pannel A and Panel B (Other-Regarding Conditions): Logit regressions (odds ratios reported) with robust standard errors clustered at the individual level displayed in parentheses. Control variables include Age, Gender, Risk (SOEP), CRT score. Constant estimated but not displayed. Significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

Moreover, in line with our theoretical predictions, we also do not observe any significant relationship between stated beliefs and subsequent lying frequency when a charity is the beneficiary of a lie, neither in the empirical nor in the normative treatment (see Figure A.2). Across all treatments, we do not observe any significant relationship between stated beliefs and subsequent lying behavior.

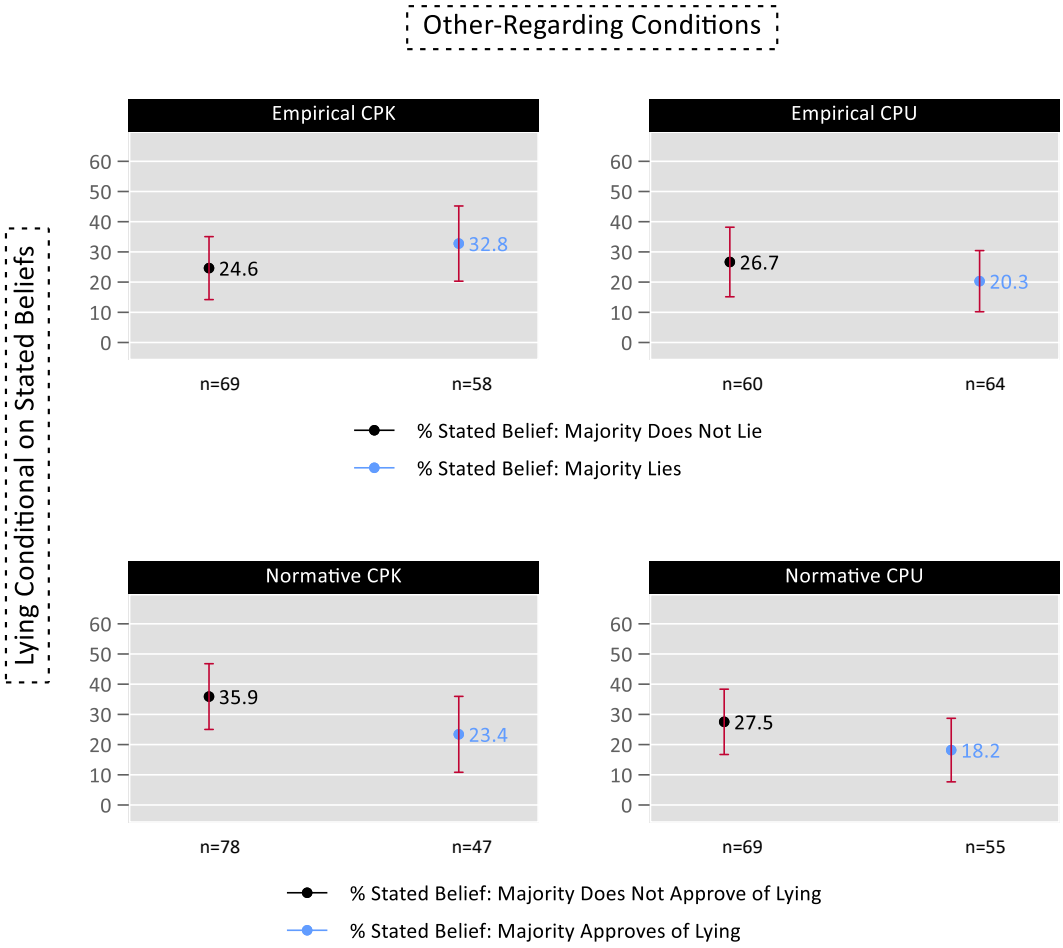

Figure A.2: Results from conditional lying frequency for the self-serving conditions (individual is beneficiary of the lie) and are broken down for the Empirical (top panel) and Normative (bottom panel) conditions. Whiskers indicate 95% confidence intervals. Stars indicate significant differences at the conventional levels of *p<0.1, **p<0.05, and ***p<0.01 and are false discovery rate corrected based on the method proposed by Benjamini and Hochberg (1995).

III. Instructions: Main Experiment

Below we present the instructions that participants were given in the respective treatments. Horizontal lines indicate that information was presented on separate screens. Color-coding emphasizes difference across treatments: Empirical Treatments — Normative Treatments — Only in CPK (and not in CPU) Treatments

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Informed Consent/ Assent Form for Non-Pool Participants Earning Money

You are invited to take part in a study named Dice Roll. The purpose of this research study is to explore human decision-making. You will complete a series of computer tasks, each involving semantic as well as visual stimuli materials. If you agree to be in this study, you will need to make decisions and answer questions regarding the study materials. We will also ask you to provide demographic information. We will not ask for your name or any information that will make you identifiable. Overall, this study will take approximately 10 minutes.

For your participation in this study, you will receive a fixed payment of $0.50. Additionally, you may receive a monetary bonus depending on your answers. The exact amount depends on your results in the experiment. The risks to participating are no greater than those encountered in everyday life. Your participation in this study is completely voluntary, and you may refuse to participate or withdraw from the study without penalty or loss of benefits to which you may otherwise be entitled. Compensation will be awarded upon completion of the entire study.

Results may include summary data, but you will never be identified. If you have any questions about this study, you may contact Hannah Harney (Email ppebelab@gmail.com ; Phone: (215) 898-3023.)

For any questions, concerns, suggestions, or complaints that are not being addressed by the researcher, please contact the Institutional Review Board at the University of Pennsylvania, 3624 Market Street, Suite 301 South Philadelphia, PA 19104-6006. Phone: (215) 898-2614.

Please feel free to print or save a copy of this consent form.
By continuing from this page, you are indicating that you have read and understand this consent form and wish to continue your participation in this study.

Thank you for choosing to participate in this study! It is important that you **read all of the instructions carefully to maximize your earnings**. This is a survey-based study where you will be asked to answer questions and complete simple tasks. At the end of the study you will be asked to fill out a short questionnaire and demographic questions.

It is expected that this study will take approximately 10 minutes. There is **no deception** in this study. Everything you see or read is true.

You begin the survey with an endowment of $0.50 and will have the opportunity to earn more based on your answers. You will be presented with a set of statements and asked to determine which statement you believe to be true. Guessing correctly will earn you an additional $0.25.

You will then roll an electronic 6-sided dice. This roll generator is **fair** and **unrecorded**. The experimenters will not know what number you rolled and the rolls are generated at random. You will report what you rolled and that will determine what, if any, additional earnings you will receive.

You may stop participating in this study at any time; however, you will not receive your payment unless you complete the entire survey through to the end. A payment code will be sent to you upon completion. Be sure to click the continue buttons at the bottom of each page after to continue through the survey.

Belief Elicitation - Self-Serving Condition

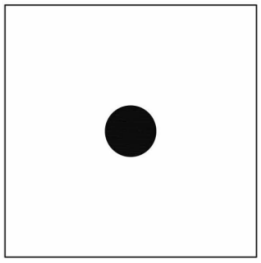
Previous participants rolled an electronic 6-sided dice. This roll generator was **fair** and **unrecorded**. The experimenters were not able to observe what number they rolled and the rolls were generated at random. Those participants then reported the roll that determined what, if any, additional earnings they have received.

Please read the following statements and determine whether you believe them to be true or false. If you answer correctly you will earn $0.25 more in bonus payment.

Which statement is **TRUE**?

- "In a similar study most people lied for their own benefit." / "In a similar study most people said it is OK to lie for your own benefit."
- "In a similar study most people did not lie for their own benefit." / "In a similar study most people said it is not OK to lie for your own benefit."

Dice Roll - Self-Serving Condition



Click button to role dice Click Here

A roll of 1, 2, 3, 4, or 6 does not result in additional earnings for you. A roll of 5 earns you an additional $0.25.

What number did you roll?

- 1
- 2
- 3
- 4
- 5
- 6

Belief Elicitation – Other-Regarding Condition

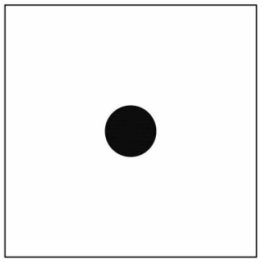
Previous participants rolled an electronic 6-sided dice. This roll generator was **fair** and **unrecorded**. The experimenters were not able to observe what number they rolled and the rolls were generated at random. Those participants then reported the roll that determined what, if any, additional earnings they have received.

Please read the following statements and determine whether you believe them to be true or false. If you answer correctly you will earn $0.25 more in bonus payment.

Which statement is **TRUE**?

- "In a similar study most people lied for the benefit of a charity." / "In a similar study most people said it is OK to lie for the benefit of a charity."
- "In a similar study most people did not lie for the benefit of a charity." / "In a similar study most people said it is not OK to lie for the benefit of a charity."

Dice Roll – Other-Regarding Condition



Click button to role dice Click Here

A roll of 1, 2, 3, 4, or 6 does not result in additional earnings for you. A roll of 5 will result in a $0.25 donation to the United Nations International Children's Emergency Fund (UNICEF).

What number did you roll?

- 1
- 2
- 3
- 4
- 5
- 6

Unincentivized questionnaire concluded the experiment (e.g., demographic questions, elicitation of risk). Exact screens available upon request

IV. Instructions: Follow-Up Experiment

Below we present the instructions that participants were given in the respective treatments (same post-experimental questionnaire as in main experiment). Horizontal lines indicate that information was presented on separate screens. Color-coding emphasizes difference across treatments:

Normative Information Provided → Empirical Information Requested —
Empirical Information Provided → Normative Information Requested

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Informed Consent/ Assent Form for Non-Pool Participants Earning Money

You are invited to take part in a study named Dice Roll Scenario. The purpose of this research study is to explore human decision-making. If you agree to be in this study, you will need to make decisions and answer questions regarding the study materials. We will also ask you to provide demographic information. We will not ask for your name or any information that will make you identifiable. Overall, this study will take approximately 5-10 minutes.

For your participation in this study, you will receive a fixed payment of $0.50. Additionally, you may receive a monetary bonus depending on your answers. The exact amount depends on your results in the experiment. The risks to participating are no greater than those encountered in everyday life. Your participation in this study is completely voluntary, and you may refuse to participate or withdraw from the study without penalty or loss of benefits to which you may otherwise be entitled. Compensation will be awarded upon completion of the entire study.

Results may include summary data, but you will never be identified. If you have any questions about this study, you may contact Hannah Harney (Email ppebelab@gmail.com ; Phone: (215) 898-3023.)

For any questions, concerns, suggestions, or complaints that are not being addressed by the researcher, please contact the Institutional Review Board at the University of Pennsylvania, 3624 Market Street, Suite 301 South Philadelphia, PA 19104-6006. Phone: (215) 898-2614.

Please feel free to print or save a copy of this consent form.
By continuing from this page, you are indicating that you have read and understand this consent form and wish to continue your participation in this study.

Thank you for choosing to participate in this study! It is important that you **read all of the instructions carefully to get your earnings**. This is a survey-based study where you will be asked to answer questions. At the end of the study, you will be asked to fill out a short questionnaire and demographic questions. All presented information is truthful and there is **no deception** in this study.

You may stop participating in this study at any time; however, you will not receive your payment unless you complete the entire survey through to the end. A payment code will be sent to you upon completion. Be sure to click the continue buttons at the bottom of each page to continue the survey.

In what follows, we describe a truthful scenario from a previous experiment to you:

Scenario: in a previous survey, participants played a game in which they rolled a die. The die was **fair** and the **roll anonymous**, i.e., the experimenter was not able to observe what number was actually obtained. Participants rolled the die and reported a number. The reported number (which could be different from the actual outcome of the roll) determined if the participant received additional earnings. Participants were told that:

- A reported outcome of **1, 2, 3, 4, or 6** would not result in additional earnings for the participant.
- A reported outcome of **5** would earn the participant an **additional $0.25**.

Please read the subsequent statements carefully and answer the questions accordingly, which can yield a bonus payment of $0.25.

As explained above, participants had the option of lying for their own self-interest without incurring in any sanctions in a previous experiment. People were also asked to express their opinions about the acceptability of lying.

Truthful statement: The majority of participants in the experiment did not approve lying for their own benefit

Truthful statement: The majority of participants in the experiment did not lie for their own benefit

Please tell us: what do you think all of the participants in the experiment actually did in the experiment?

Important: guessing correctly will yield an additional bonus payment of $0.25. The correct answer will be revealed at the end of the experiment.

I believe that the...

- Majority of all participants **lied** for their own benefit
- Majority of all participants **did not lie** for their own benefit

I believe that the...

- Majority of all participants **approved of lying** for their own benefit
- Majority of all participants **did not approve of lying** for their own benefit

Please explain your reasoning in detail (text box):

You were just told that the "**majority** of participants in the experiment did not approve lying for their own benefit".

You were just told that the "**majority** of participants in the experiment did not lie for their own benefit".

Please tell us what you believe this "majority" corresponds to in % between 50.1% and 100%.

Input: ___

Post-experimental questionnaire followed (same as in main experiment)