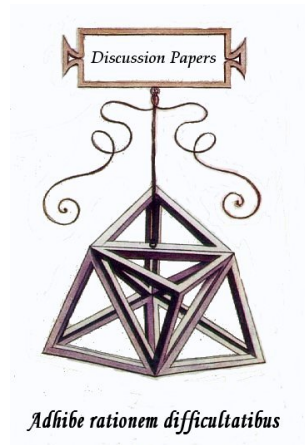




Discussion papers

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Pietro Guarnieri, Lorenzo Spadoni

**Norms and anti-coordination:
elicitation and priming
in an El Farol Bar Game experiment**

Discussion paper n. 303

2024

*Discussion paper n. 303, presented: **January 2024***

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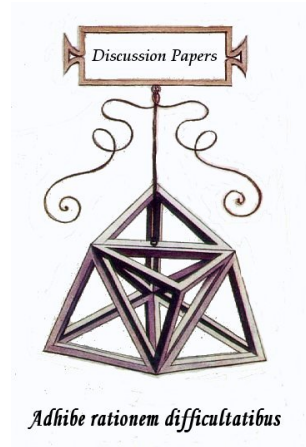
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Please cite as:/Si prega di citare come:

Pietro Guarnieri, Lorenzo Spadoni (2024), “Norms and anti-coordination: elicitation and priming in an El Farol Bar Game experiment”, Discussion Papers, Department of Economics and Management – University of Pisa, n. 303 (<http://www.ec.unipi.it/ricerca/discussion-papers>).

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Norms and anti-coordination: elicitation and priming in an El Farol Bar Game experiment

Abstract

In this experimental study, we delve into the role of personal and social norms in an anti-coordination decision, such as the choice between staying home or going out in the El Farol Bar Game. Our design consists of two interconnected studies: in Study 1, we elicit either empirical or normative expectations before subjects make their decision in a one-shot El Farol Bar Game; in Study 2, subjects play two El Farol Bar games with different social-expectation primes. Our results reveal that the majority of subjects believe that staying home is the right thing to do and tend to act in accordance with their normative belief. Nevertheless, there is no prevailing consensus on what others believe is normatively right (normative expectations), and subjects do not base their decisions on these expectations. Conversely, a substantial majority of subjects expects that the predominant behavior is staying home (empirical expectations), and subjects tend to adhere to their empirical expectations. As far as social-expectation primes are concerned, they only lower subjects' propensity to go out. This happens only when the prime conveys an empirical expectation to go out or a normative expectation to stay home. Furthermore, we observe a relatively low rate of change in the second El Farol Bar decision, and this does not hinge on the prime content.

Keywords: anti-coordination games; social expectations; normative beliefs

JEL Classification: C90; D83; D84; D91

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Pietro Guarnieri* Lorenzo Spadoni†

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1 Introduction

In an anti-coordination problem, individuals face a situation where there is a negative network externality. As more people undertake the same action or consume a particular good, it leads to a cost or reduced benefit for each individual. Anti-coordination problems imply social dilemmas that are pervasive in situations where resources or services are shared, and their effectiveness or utility diminishes as more people use them. This can be observed in sectors such as transportation, where heavy traffic results in longer commute times and more crowded public transportation, reducing the convenience for individual commuters. Similarly, it can apply to communication networks where increased usage may lead to slower data speeds or overcrowded channels, impacting the quality of service for users. Typically, congestion occurs when a certain threshold in the number of consumers is reached. This is the case, for instance, of the overuse of energy, wherein excess of demand can cause power outages if a certain threshold is overcome.

The El Farol Bar Game (EFBG) provides a stylized representation of a relevant anti-coordination problem in the fruition of public places (Arthur, 1994). Imagine that three people need to decide whether to go to their favorite public place or remain at home. The place is enjoyable only in the case up to two of them go, but if the three of them go at once the place becomes overcrowded and not enjoyable anymore. In fact, they would prefer stay home rather than end up in an overcrowded place. This situation represents exactly the frame of the decision task that UK subjects faced in the online experiment we ran in January 2022.

This design allowed us to address a puzzle that concerns subjects' capability to solve the anti-coordination problem by referring to the social norms they hold. While social norms are often used by human subjects to foster cooperation and manage social coordination (Reno et al., 1993; Kallgren et al., 2000; Fehr & Fischbacher, 2004; Bicchieri, 2005; Biel & Thøgersen, 2007; Thøgersen, 2008; Gächter et al., 2013; House, 2018; Peysakhovich & Rand, 2016; Bicchieri, 2016; Fehr & Schurtenberger, 2018; Bicchieri et al., 2022) their use in anti-coordination issues involves peculiar difficulties. Indeed, compliance with a social norm would result in undesired congestion or waste of resources. For instance, in the EFBG, if an individual perceives that the prevailing social norm makes people go out, she would better stay home, and *vice versa*. However, if each subject reasoned the same way and deviated from the perceived social norm, the social norm would vanish, since no one would follow it. This apparent paradox motivated us to address the role of social norms in anti-coordination issues by deploying a method encompassing both elicitation of and priming with social norms.

Our pre-registered online experiment comprises two interdependent studies. In Study 1, we use Cristina Bicchieri's methodology to elicit social expectations and personal normative beliefs (Bicchieri & Xiao, 2009; Bicchieri & Chavez, 2010) and we make subjects play the El Farol Bar Game afterward. To avoid endogeneity, we separately elicited empirical expectations (i.e., the expectation about the behavior held by the majority) and normative

expectations (i.e., the expectation about the normative beliefs held by the majority) in two independent samples. As a consequence, we can provide two kinds of evidence in Study 1. The first one is a measure of social expectations and normative preference – the latter coming from the elicitation of normative expectations that include subjects’ statements concerning what behavior they believe is the normatively right (personal normative beliefs, in Bicchieri’s definition). The second is an analysis of EFBG decisions conditional on social expectations and personal normative preferences. In Study 2, we use the social expectations obtained in S1 to prime EFBG decisions. Specifically, subjects play two EFBG rounds, receiving a different prime in each of the two – with the only exception of the first round of a Baseline treatment where no priming is implemented. Consequently, we can deliver two other kinds of evidence. One concerns the capability of priming to affect EFBG decisions compared to the Baseline. The other concerns the subject’s propensity to change behavior after a consistent or inconsistent second priming is provided.

With these methodologies, we aim to cast a new light on the functioning of social norms in conditions where the structure of the anti-coordination problem – and related uncertainty in subjects’ beliefs on others’ behavior and beliefs – can make the reliance on social expectations more complex. This complexity represents a challenge to the theory of descriptive and social norms advanced by Cristina Bicchieri (Bicchieri, 2005, 2016). In a nutshell, the structure of the EFBG allows for investigating a number of theoretical hypotheses that concern a) the plurality of descriptive norms b) the independence of injunctive from descriptive norms; c) a key role of personal norms in case of pluralism of normative and social values; d) a different functioning of social expectation and personal norms when elicited in subjects as compared to when they are used as primes of decisions. We discuss these hypotheses while accounting for our design decisions in the next section. Section 3 presents our findings and Section 4 discusses them and concludes.

2 Theory and methodology

2.1 The experimental design

The experiment is composed of two studies that were pre-registered on AsPredicted.org (Study 1, #76674; Study 2, #77445).¹ In Study 1 (S1), we elicit subjects’ social expectations and personal normative preferences concerning an EFBG decision task performed by other subjects. In Study 2 (S2), we use the social expectations elicited in S1 as information to prime EFBG decisions. In both studies, the EFBG task is the same.

Table 1 represents the payoffs of the EFBG with three subjects. Each subject can choose between two options, "stay home" (*sh*) and "go out" (*go*). If all subjects decide to go out, each one receives a reward of γ ; those who opt to stay home receive α . If one or two

¹The preregistrations, datasets and replication files are available on a OSF repository. The instruction screens of each study are reproduced in the Supplementary material.

subjects decide to go out (while the others stay home), each of them is rewarded with β , with $\beta > \alpha > \gamma$. The game has three asymmetric pure-strategy Nash equilibria, in which one subject chooses *sh* while the other two choose *go*. Additionally, there is a unique symmetric mixed-strategy Nash equilibrium where all subjects choose *go* with a probability $p = \sqrt{\frac{\beta-\alpha}{\beta-\gamma}}$ (e.g., Gintis, 2009).

TABLE 1: Payoffs matrix of the EFBG

s_i/s_{-i}	<i>sh,sh</i>	<i>sh,go</i>	<i>go,sh</i>	<i>go,go</i>
<i>sh</i>	α	α	α	α
<i>go</i>	β	β	β	γ

Notes.

Parameters: $\alpha = 0.20$ GBP, $\beta = 0.40$ GBP, $\gamma = 0.00$ GBP.

In our experimental design, we randomly match subjects in groups of three and set the parameters as follows: $\alpha = 0.20$ GBP, $\beta = 0.40$ GBP, and $\gamma = 0$ GBP, resulting in a mixed-strategy Nash equilibrium (MSNE) with $p = 0.71$. Subjects can not play mixed strategies, as our design permits only pure strategies and entails a one-shot decision. Notwithstanding, we consider the MSNE in the comparison with average behavior to have a reference for its potential impact on decisions.

The EFBG, originally introduced by Arthur (1994), falls into the category of anti-coordination games in which symmetric pure strategies fail to result in socially efficient outcomes. To the best of our knowledge, the only experimental study with an EFBG explicit design is presented in a paper by Leady (2007), who specifically investigates learning and imitation over time. The results show that subjects do not tend to play the pure strategy Nash equilibrium of the stage game and, additionally, they consistently emulated the strategies that were the most successful. However, there are two other anti-coordination games whose structure shares some distinctive characteristics with our design.

Indeed, our version of the EFBG, where only one subject needs to stay home to reach the social efficient outcome, is isomorphically invariant to the payoff structure of the Volunteer’s Dilemma (Diekmann, 1985), investigated in several experimental studies (e.g., Goeree et al., 2017; Kopányi-Peuker, 2019). The framing of this design makes the normative value of self-sacrifice salient. The dilemma involves players choosing between self-sacrifice for the collective benefit or relying on someone else to make the sacrifice. Diekmann & Przepiorka (2016) demonstrate how latent norms emerge when subjects repeatedly engage in the Volunteer’s Dilemma. Specifically, in heterogeneous groups, those with the smallest cost make sacrifices, while in homogenous groups, prosocial actions are taken in turn.

Moreover, our EFBG presents subjects a decision task similar to the one of the the Minority game. In this game, each player has two options, and choosing the one that is chosen less frequently in the group results in the highest payoff. In our set-up of the EFBG if one player expects that there is a majority opting for a certain option, she realizes a higher

payoff if she chooses the opposite and plays as a minority. However, the two games are not isomorphically invariant. In the EFBG, if the player expects that only one player opts for going out, she would prefer to go out, becoming part of a majority. The minority game has been often applied in designs with repetition and feedback. Bottazzi & Devetag (2007) focus on subjects' response to information feedback, and find that providing players with information about individual choices within the group does not enhance aggregate efficiency compared to situations where this information is not available. Linde et al. (2014) employ a multi-round strategy method and find that subjects in Minority games tend to randomize their strategies. Moreover, although subjects rarely use strategies consistent with the Nash Equilibrium, the aggregate outcomes are close to those predicted by game theory (see Kets, 2012 for a discussion about learning in minority games).²

A few crucial differences between our design and Volunteer's and Minority games serve as a motivation for the set up we adopted. Compared to the Volunteer's dilemma, in the EFBG framing social expectations and norms are more relevant. While the framing of the Volunteer's dilemma makes the intrinsic motivation to self-sacrifice salient, the EFBG decision emphasizes strategic uncertainty. Indeed, the EFBG tells a story of a desired outcome that, depending on others' decisions, is at risk of over-consumption. This narrative appears different from the one of the Volunteer's dilemma which is focused on the possibility to restrain from consumption to benefit others. On the other hand, in the Minority game, there is no option that would guarantee the avoidance of the socially inefficient outcome – as it is in both the EFBG and the Volunteer's dilemma. Consequently, personal norms or social preferences hardly apply to this decision that mainly depends on empirical considerations, i.e., the expectation about the majority.

Overall, by opting for the EFBG, we aimed at a design where both normative and empirical aspects are at stake and concur in the framing of the decision problem. In order to obtain a cleaner identification of personal normative preferences and perceived (empirical and injunctive) social norms, we sterilized potential learning and imitation effects by designing a one-shot interaction both in S1 and S2. The circumstance that the experiment was run online further strengthen anonymity and independence in subjects decisions, thus preventing group identity or other contextual cues possibly affecting social expectations and behavior. Moreover, we frame the task in terms of the alternative between staying home or going out to a public place, in order to foster the identification of subjects with a familiar decision. Given the simplicity of the strategic decision we propose, we consider that context-framed instructions might also enhance the understanding and reduce potential confusion driven by a more abstract formulation (Alekseev et al., 2017).

²Other examples of anti-coordination games that have been experimentally investigated include Entry Market games (e.g., Erev & Rapoport, 1998; Rapoport et al., 1998 and the Route choice game (Iida et al., 1992 and Selten et al., 2007 specifically designed this game with two routes, which is the closest analog to ours).

2.1.1 Study 1

Study 1 consists of two parts. In the first part, social expectations and personal normative preferences are elicited; in the second part, subjects face the EFBG task. Both parts are incentivized, but subjects receive the payoffs of either one or the other with a probability equal to 0.5.³ Specifically, in the first part, we apply the method of measurement developed by Cristina Bicchieri and coauthors (Bicchieri & Xiao, 2009; Bicchieri & Chavez, 2010) and elicit empirical expectations (*ee*) and normative expectations (*ne*) held by two independent samples. We separate the elicitation of the two kinds of social expectations to avoid potential endogeneity between the two measures. We have opted for Bicchieri’s method – instead of other methods of identification of social norms (e.g., Krupka & Weber, 2013) – because it provides us with measures that can be used to distinguish between perceived descriptive and injunctive norms and disentangle their potentially different role in anti-coordination problems. The elicitation questions are introduced as a poll concerning other subjects’ decisions in the baseline of S2. To favor the understanding of the EFBG, subjects in S1 are shown the exact decision screen used in the baseline of S2.

The *ee* are measured as the individuals’ expectations of the mode of decisions in S2, i.e., the subjective belief concerning which action the majority of subjects in the baseline of S2 would undertake. Notably, we referred this question to the whole sample of subjects in S2 instead of the majority in each group in order to induce subjects to conjecture an overall behavioral norm and prevent them from focalising on the role of a single decision-maker who could become pivotal in determining such a majority. Those who guessed the correct mode of S2 gained a payoff of 0.20 GBP.

To elicit *ne* we first elicit personal normative beliefs (*nb*), i.e., the personal normative preference concerning the action that is right to choose in the decision at stake. Accordingly, we consider *nb* as representative of personal norms as opposed to the subjective perception of social norms that in Bicchieri’s theory are revealed by social expectations, i.e., *ee* and *ne* (Bicchieri, 2005, 2016). *ne* are measured as the individuals’ expectations of the mode of *nb* of subjects in S1, i.e. the subjective belief concerning which action the majority of subjects in S1 considers the right thing to do from a normative point of view. While the elicitation of *ne* is incentivized – 0.20 GBP for the correct guess – *nb* elicitation is not. For the elicitation of *ne*, we referred to the whole sample of subjects in S1. One might observe that while *ee* refer to the behavior of subjects in S2, *ne* refer to personal normative beliefs of subjects in S1. However, this does not cause incomparability between the two measures. On the contrary, the two measures concern expectations that are held only by individuals of S1 and both refer to circumstances in S2. Indeed, *ne*, exactly like *ee*, refer to S2 to the extent that personal normative beliefs concern what one ought to do if confronted with the decision situation of S2 – even if they are elicited as personal beliefs and expectations on

³Hedging appears very unlikely since stakes are very low and a possible strategy to manage risk is non-transparent (Blanco et al., 2010) given that the task of the second part is not fully revealed in advance, as explained below.

them held by subjects in S1. On the other hand, *ee*, exactly like *ne*, consist of beliefs held by subjects in S1 – even if they are referred to behavior in S2.

In the second part, subjects performed the EFBG. It must be underlined that subjects know since the beginning that the study they participate in consists of two tasks and that the second task is a decision task. However, the circumstance that they will play the EFBG is presented only after norm elicitation. The reason for this omission pertains to the risk of a mutual influence between decisions in the two parts. If the EFBG task of the second step was announced before subjective norm elicitation, subjects might have been prone to self-confirmation by adapting their expectations on their decision in the EFBG, or *vice versa*. Figure 1 reports the structure and sample size of S1, reporting also for each elicitation condition how many subjects hold *sh* or *go* either as *ee* or *ne*.

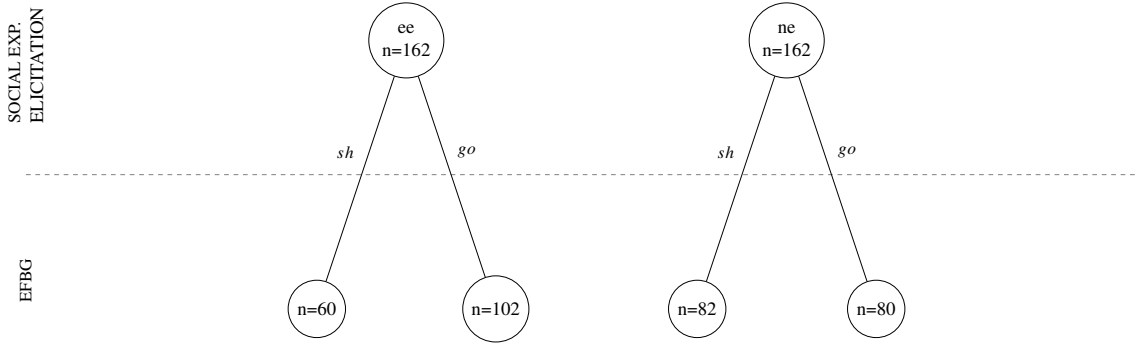


FIGURE 1: Study 1 design and sample sizes

2.1.2 Study 2

Study 2 consists of two parts. In both parts, subjects perform the EFBG, but before each decision they receive different information depending on the treatment. We have three sets of treatments categorized after the type of priming subjects receive in the first part of S2. The first set of treatments groups all treatments in which subjects do not receive priming before the first EFBG decision. In the second set, subjects are primed with *ee* before the first decision, while in the third with *ne*. Since we are interested in investigating the impact on decisions not only of the type of social expectation (i.e., *ee* vs *ne*) but also of its content (i.e., whether subjects stated *sh* or *go* as their expected majority), following Bicchieri & Chavez (2010), we explicitly referred to the results of single sessions of S1 to prime with all possible combinations of types and contents of social expectations.⁴ Henceforth, we denote the primings with the first two letters indicating the social expectation subjects were

⁴As illustrated in Appendix A we obtained every possible combination of types and contents in the sessions of S1.

primed with (i.e. *ee* or *ne*) and with the second two letters indicating the content of the expectation (i.e. *sh* or *go*). As an example *ee_sh* stands for the treatment where we provided the empirical expectation of subjects for whom the majority is going to stay home. The first row of Figure 2 reports all the primings implemented in the first part of S2 with the respective sample sizes.⁵ In the second part of S2, subjects in the Baseline treatments were primed with all of the possible combinations of priming; subjects who were primed with *ee*, were primed with *ne*; subjects who were primed with *ne*, were primed with *ee*. Specifically, for each possible priming received in the first part, subjects receive a second priming which is different in the type and either equal or different in the content. The second row of Figure 2 reports all the primings implemented in the second part of S2 with the respective sample sizes.

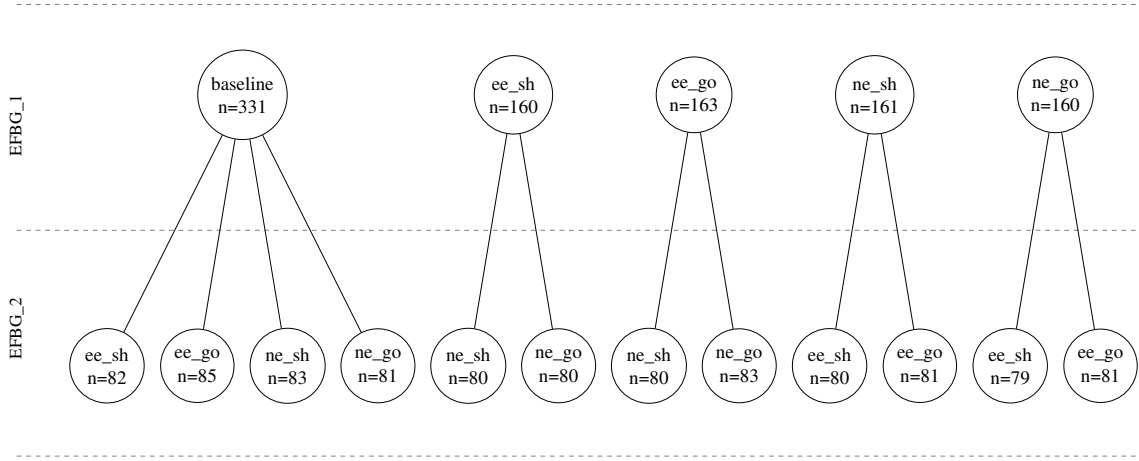


FIGURE 2: Study 2 design and sample sizes

As in S1, the information about the nature of the decision task in the second part is omitted (but the subjects know that the study consists of two decisions). This was done purposely to avoid hedging (Blanco et al., 2010) and to keep the first decision and the effect of the first priming insulated from possible anticipations about the second decision. On the other hand, this omission makes the second priming more salient (since it appears unannounced) and consequently the second decision more independent with respect to the first one. Moreover, between the first and the second decision, no feedback was provided and a re-match of subjects in groups was implemented in order to weaken potential learning effects and avoid possible reciprocity within groups.

2.2 Social and personal norms in anti-coordination problems

While relying on Cristina Bicchieri's elicitation methodologies, our study aims at testing in the context of anti-coordination problems some hypotheses embedded in her theory

⁵The very tiny unbalance in subject numbers between treatments is likely due to drop-outs of subjects during the experiment. Only seven subjects dropped out during experimental sessions. As illustrated below, this represents a very low attrition rate.

of descriptive and social norms. In her view, when subjects prefer to conform to a rule of behavior because they expect that most people in their reference network conform to it (empirical expectation), they are complying with a mere descriptive norm; but when they additionally expect that most people in their reference network believe they ought to conform to such a rule of behavior (normative expectation) they are complying with a social norm (Bicchieri, 2005, 2016). This theory has two implications. First, while descriptive norms can independently act on behavior, injunctive norms have only an auxiliary function. Normative expectations – which in Bicchieri’s view replace the notion of injunctive norms as second-order beliefs concerning others’ normative beliefs – do not play any autonomous role, but only in conjunction with empirical expectations when the two concur in grounding social-norm following. Second, consequently, subjects can make inferences only from descriptive to injunctive norms, and, when the two conflict, empirical expectations dominate normative expectations as a driver of social behavior. Indeed, anti-coordination problems challenge this theoretical apparatus. We briefly present some issues that our design tries to address.

Descriptive norms work as an effective coordination device when the prosocial outcome coincides with behavioral conformity (Reno et al., 1993; Muldoon et al., 2014; Kraft-Todd et al., 2015; Zhang et al., 2022; te Velde & Louis, 2022; Schram et al., 2022). But when social cooperation is realized by divergence in behavior, direct compliance with descriptive norms would result in anti-coordination failure, with subjects ending up with an inefficient outcome. Take as an example the use of an energetic resource such as electricity that is provided to consumers as a flow and is thus subject to overshooting (power outages) if too many subjects try to access it at a specific moment in time. In this case, simple compliance to the perceived descriptive norm would result in over- or under-utilization of the resource. This circumstance may lead subjects to use the descriptive norm in a strategic way by deviating from it to obtain a higher benefit – for instance, they can avoid consuming the resource when they expect that others use it or reduce their quota of consumption (Campigotto et al., 2023). As a consequence, the empirical expectation can lead subjects to follow either the rule of behavior of the descriptive norm or the opposite one. Accordingly, due to the structure of the anti-coordination problem, more than one descriptive norm can coexist and subjects might be uncertain whether to follow their expectation or not. This, in turn, might affect the empirical expectation itself, with subjects facing difficulty in determining their expectation of the descriptive norm due to the presence of strategic behavior.

Subjects can then turn to injunctive norms – the approval/disapproval of a person’s conduct by the majority of others in the reference network (Cialdini et al., 1991) – that appear to be relevant in a situation where anti-coordination produces social cooperation and normative values might apply. Indeed, social values and appropriateness typically act as a strong driver of compliance with the conduct that would ensure collective benefit at personal costs, for instance, in the domain of public health or pro-environmental behavior

(Biel & Thøgersen, 2007; Reid et al., 2010; Farrow et al., 2017; Cialdini & Jacobson, 2021; Macy et al., 2021; Bicchieri et al., 2021). However, in the case of anti-coordination problems different rules of behavior can emerge and be assigned with alternative normative or social values. Indeed, alternative injunctive norms can be referred to interpret the different behavioral options driven by diversity in individuals' normative convictions or diversification between groups and sub-networks. Social distancing during the COVID-19 pandemic provides a (dramatic) clear example of a circumstance where the variability of personal or group orientations concerning what is good for individuals or society as a whole challenged subjects' capability to solve norm conflict connected to large (anti-)coordination and cooperation problems (Forsyth, 2020; Neville et al., 2021; Ruggeri et al., 2023; McGuire et al., 2023). In such an occasion, subjects' perceptions of conflicting rights such as personal/public health and personal freedom clashed resulting in polarization and a non-negligible portion of the population being reluctant to comply with prevalent rules of behavior suggesting people avoid public spaces (or even with laws) or contribution to public goods such as those connected to vaccination campaigns.

Anti-coordination problems point out some key insights on the role of injunctive norms and personal normative beliefs in circumstances where more than one rule of behavior can be at stake. First, we might posit that an injunctive norm could drive social behavior also independently of the descriptive norm. Consequently, the two might not align and contrast each other as substitutes rather than complements, as in Bicchieri's framework. In other words, injunctive norms could produce a social behavior that is different from the one that is expected to be upheld by a significant majority of others. Moreover, there can be no predominant empirical expectation in the reference population and more than one descriptive norm might be effective. In such a circumstance, subjects could infer their empirical expectation from their normative one. In other words, they could expect that others will follow the rule of behavior that they consider the one attributed with normative value in their reference network. Contrarily, possible conflict in the normative interpretation of the alternative behavioral options can make the identification of injunctive norms difficult for subjects. In this case, the uncertainty involving normative expectations could make subjects solve the anti-coordination dilemma relying on personal norms – i.e. their personal intrinsic and non-interdependent preference for adopting a certain behavior because personally considered normatively right.

These considerations are in line with the idea of a "coordinating power of social norms" – for which normative beliefs, for instance, concerning social appropriateness, help individuals in coordination (Krupka & Weber, 2013; Krupka et al., 2022; Fallucchi & Nosenzo, 2022) – and with the idea of pluralistic ignorance for which those beliefs can be in contrast with perceived descriptive norms (Smerdon et al., 2020; Sargent & Newman, 2021). Moreover, recent literature has highlighted a guiding role of personal norms and intrinsic deontological considerations (Gawronski et al., 2017; Baron & Goodwin, 2020; Gawronski et al., 2020; Baron & Goodwin, 2021; Baron & Gürçay, 2017; Capraro & Rand, 2018;

Capraro et al., 2022; Catola et al., 2021b,b; Bašić & Verrina, 2021). Accordingly, we opted to avoid any specific hypothesis on the hierarchy between descriptive, injunctive, and personal norms, and rather we focus on their distributions (Dimant, 2023). Accordingly, we assume that a) we could observe more than one descriptive or injunctive norm in our population b) injunctive norms could play an independent role with respect to descriptive norms and c) personal normative beliefs could compensate for the lack of identification of either descriptive or injunctive social norms.

Another crucial aspect that anti-coordination problems make salient concerns the potential difference between how social expectations are endogenously used in the spontaneous decision process and how subjects use them when provided as exogenous information. This aspect is typically disregarded in the literature on social expectation that basically assumes that the reaction to primes with social expectations coincides with subjects' actual attitudes towards the expectations they uphold. This identification hardly applies in an anti-coordination setting given the multiplicity of possible interactions between the kinds of social and personal norms we presented. Indeed, the impact of primes based on social expectations on social behavior might be various. For instance, using descriptive norms to nudge anti-coordination – for example by publicly disclosing the behavior adopted by the majority in the reference population – may drive compliance, but they could also induce the opposite behavior and backfire (Schultz et al., 2007; Bavel et al., 2020; Kraft-Todd et al., 2015; Agerström et al., 2016; Bicchieri & Dimant, 2022). A good example of this norm-nudging failure is the information provided by highway authorities about the roads expected to be blocked by cars during pick hours. This information aims at suggesting alternative paths, but, by making salient those alternative roads where drivers could anti-coordinate (by deviating from the descriptive norm), they potentially induce congestion on them (Iida et al., 1992; Selten et al., 2007). For example, in a laboratory experiment, Knorr et al. (2014) explored the effects of pre-trip information. Their results indicate that while providing identical information to all road users does not yield significant benefits, a more efficient traffic outcome emerges when only a few subjects have access to additional information. Alternatively, policymakers might try to appeal to citizens' normative commitment also by using injunctive norms, e.g., by providing information about what is commonly considered as the right thing to do in the reference population. Despite information about injunctive norms is found to be effective both as substitutes or complements of descriptive norms (Reno et al., 1993; Cialdini et al., 2006; Zou & Savani, 2019; Bonan et al., 2020), also in this case, drawbacks are not infrequent also driven by personal resistance due to the feeling of loss of self-determination and autonomy (Felsen et al., 2013; Schmelz & Bowles, 2021).

2.3 Research questions

In what follows, we present and discuss our research questions to put forward the analytical categories that will be used to interpret our results and to help the reader position our contribution within the existing literature. We discuss each research question in separate

subsections. The title of each subsection rephrases and synthesizes the text of the research questions that were pre-registered. The first two refer to S1, and the latter two to S2.

2.3.1 RQ.1: Which personal and social norms do subjects hold?

The elicitation of *ee* and *ne* in S1 provides us with measures of perceived social norms in our sample. As introduced above, we avoided eliciting the two measures of social expectations in single individuals to avoid mutual influence between the responses to the elicitation questions. Consequently, what we obtain is the distribution of perceived descriptive norms from the elicitation of *ee* and of injunctive norms from *ne*. More specifically, we will be able to ascertain a) whether a significant majority of subjects holds either *sh* or *go* as the descriptive/injunctive norms by testing the difference with the 50% distribution, b) whether the perceived descriptive norm is different from the perceived injunctive norm by testing the difference between average responses to our elicitation questions.⁶

Concerning personal norms, recent studies have validated the elicitation of *nb* as a reliable index of individual normative preferences, not affected by self-confirmation (Catola et al., 2021b,a). Although this elicitation is not incentivized, we assume that subjects are revealing their personal norm, also because, as explained above, they are not aware that they are going to play the same game referred to in the elicitation question. Accordingly, we obtain an index of the distribution of *nb* which enables us to detect whether there is a majority of subjects who personally consider *sh* or *go* as the normatively right thing to do. To avoid a comparison that could be affected by endogeneity, we avoid testing the difference between *nb* and *ne*, but we only analyze whether there is a certain normative preference held by the majority (difference with the fifty-fifty distribution) and whether this preference differs from the perceived descriptive norm (difference between *nb* and *ee*). In case of difference in the latter comparison, we could infer that pluralistic ignorance might be at stake since subjects would hold a normative preference for a certain behavior, but expects others to follow the opposite rule of behavior.

2.3.2 RQ.2: Which personal or social norm do subjects follow?

To investigate whether the perceived social norms and personal norms drive behavior, we can look at behavior in S1 and compare it to the baseline behavior in S2 – where neither norm elicitation, nor priming with normative expectations is performed. Indeed,

⁶The comparison between average responses to *ee* and *ne* elicitation (and related behavior, as discussed in the next subsection) is based on the possibility to consider the two samples of S1 as representative of a unique overall sample. In other words, the two elicited distributions should be the same as the distribution of *ee* and *ne* if we elicited them in a sample randomly grouping together the two independent samples we used (*coeteris paribus* the endogeneity issue discussed). As shown in Appendix C, we have large samples that are homogeneous between conditions with respect to key individual characteristics. On this basis, we assume that our two measures of *ee* and *ne* are mutually comparable and representative of descriptive and injunctive norms that would be held by the overall population involved in S1. This argument, which applies also to S2, grounds our assessment of the subsistence of social norms.

we consider that *ee*, *ne* and *nb* drive decision-making in S1 only in case the decisions in the EFBG task performed after norm elicitation is different from average behavior in the Baseline of S2. Moreover, we consider that average behavior reveals compliance either to the perceived descriptive and/or the injunctive norms only in case there is consistency between decisions in the EFBG and the detected majorities (if any) in the elicitation of *ee* and/or *ne*, respectively. On the other hand, to assess whether personal norms play a role as an alternative driver of behavior, we will test the consistency between the elicited *nb* and EFBG decisions and then, whether there is a difference in the observed behavior with respect to decision conditional on both *ee* and *ne*.

A last remark concerns norm compliance in general. Indeed, it might be the case that subjects use the perceived social norms in a strategic way and decide not to comply with them in order to obtain anti-coordination with respect to others. Accordingly, we could observe a portion of subjects who do not comply with the prevalent social expectations they hold. This strategic way of using social expectations could in principle apply to both descriptive and/or injunctive norms.⁷ In principle, this idiosyncratic behavior should not be observed in the case of personal norms that should be followed just because intrinsically believed to be normatively valid, and not based on considerations regarding others.

2.3.3 RQ.3: Does priming with descriptive or injunctive norms affect decisions?

To respond to this research question we will look at EFBG choices in the first part of S2. We consider that providing information about descriptive and injunctive norms perceived by subjects (i.e., priming with social expectations) in S1 affects decisions only in case average behavior differs from the one adopted in the Baseline of S2. We conjecture that the processes activated by the elicitation of social expectations and those consequent to the reception of exogenous information about social expectations (of others) differ in several respects, e.g., the awareness concerning one's own motives and behavior and those of others, subjects' sense of autonomy and self-determination, the connection to cognitive modes or emotions. Consequently, social expectations can differently drive behavior in S1 and S2. Specifically, as noticed also for EFBG decisions in S1, subjects can use the information about social expectations in a strategic way and decide not to comply with the descriptive or injunctive norms elicited in S1 to solve the anti-coordination problem.

⁷We define strategic utilization of social expectations as the deliberate choice not to adhere to them. In our version of the EFBG, this choice represents the optimal response when one expects that the majority, namely the other two players, will conform. This perspective aligns with models of level-k thinking (Camerer et al., 2004), particularly in scenarios where one assumes that all other subjects are complying. For the sake of clarity, we consistently refer to the strategic use of social expectations when it involves non-compliance. However, it is worth noting that compliance can also be a strategic choice if, for example, a player anticipates, by being one step ahead, that others are strategically, albeit to a lesser degree, opting for non-compliance. Selten et al. (2007) provide an alternative way to assess whether subjects rely on such a strategic reasoning, by setting a repeated anti-coordination game and observing the behavior chosen by subjects after being exposed to others' actual choices. This approach helps in discriminating between "direct" vs "contrary" response modes to empirical observation of actual events, not relying on assumptions on others' type.

2.3.4 RQ.4 Does (in)consistency of priming affect decisions?

With this research question, we aim to explore whether the priming performed in the second part of S2 changes subjects' decisions (with respect to EFBG decisions in the first part). Specifically, we are interested in investigating whether consistency or inconsistency between the two pieces of information provided in the two primes induces different behavior across conditions. Consistency occurs when the second priming has the same content as the first one, i.e. when the descriptive and the injunctive norms indicate the same rule of behavior. Contrarily, we have inconsistency when the second priming has the opposite content. We expect that consistency results in a lower share of switching of decisions between the first and the second part with respect to inconsistency. In the case of inconsistency, based on Bicchieri's theory, we could expect that subjects will tend to comply with the prime in terms of the descriptive norm (the *ee*) and not to the one in terms of the injunctive norm (the *ne*), irrespective on the part of the experiment in which the priming is implemented.

3 Results

The experiment was implemented using oTree (Chen et al., 2016) and conducted on the online platform Prolific.com (Palan & Schitter, 2018) between October 2021 (Study 1) and January 2022 (Study 2). The experiment involved 1,299 subjects (324 in Study 1 and 975 in Study 2) living in the UK at the time of the experiment, and both studies lasted an average of 2 minutes.⁸ Subjects were randomly assigned to treatments and could not participate more than once. Subjects received a participation fee of 0.25 GBP in both studies and an average bonus of 0.24 GBP (0.18 GBP in Study 1 and 0.26 GBP in Study 2), approximately 14.66 GBP per hour including show-up fees. The resulting overall payment is compliant with the prescriptions for online experiments on Prolific.com.

Upon conducting a *post hoc* analysis using G*Power 3.1 (Faul et al., 2009), we found that our study has a statistical power of 0.8.⁹ Only 6 subjects left the experiment before completion. This represents an exceptionally low attrition rate (as reported in Appendix B), compared to prevailing trends in online experiments (see Arechar et al., 2018 for a discussion about attrition rates in online experiments). This result can be attributed to the concise and straightforward mode of presenting instructions on graphically organized screens, as well as the swift and intuitive nature of the tasks. Overall, we can exclude that sample selection occurred.

In what follows, we present the evidence collected in the two studies following the order of our Research questions. Accordingly, we begin with RQ.1 and present our measures of subjects' personal norms and perceptions of social norms as elicited in Study 1 (Figure 3).

⁸An initial pilot of Study 2 was conducted with 80 subjects for exploratory purposes, but the data gathered from the pilot was not utilized in the present analysis.

⁹The *post hoc* power analysis relies on the Cramer's V measure of effect size, a commonly used metric for chi-squared tests (as discussed in Fritz et al., 2012).

These measures are provided as averages of the three dichotomous variables ee , ne and nb that take a value of 0 when indicating “stay home” and 1 when indicating “go out”. In the case of our index for personal norms nb , we observe that 32.1% of the subjects believe that going out is what one ought to do. As concerning ee , a significant majority (63%) of subjects expect that the majority of subjects in S2 opts for staying home (binomial test vs 50%: $p = 0.001$), while only 37% expect the opposite. Contrarily, we do not observe any significant majority in the case of ne (binomial test vs 50%: $p = 0.937$). We got that 50.6% of subjects expect that the majority of others believes that staying home is what one ought to do, while 49.4% expect the opposite. The two measures of social expectations are significantly different from each other ($\chi^2 = 5.031$, $p = 0.025$), and nb is not statistically different from ee ($\chi^2 = 0.873$, $p = 0.350$) (we do not compare nb and ne since in principle we can not exclude that the two measures are interrelated). These results altogether let us single out a first piece of evidence:

Evidence 1 *Most subjects hold a descriptive norm for which the majority stay home, but there is not a prevalent opinion about what others believe is normatively right to do. Notwithstanding, as far as their personal norm is concerned, a significant majority believes that one ought to stay home.*

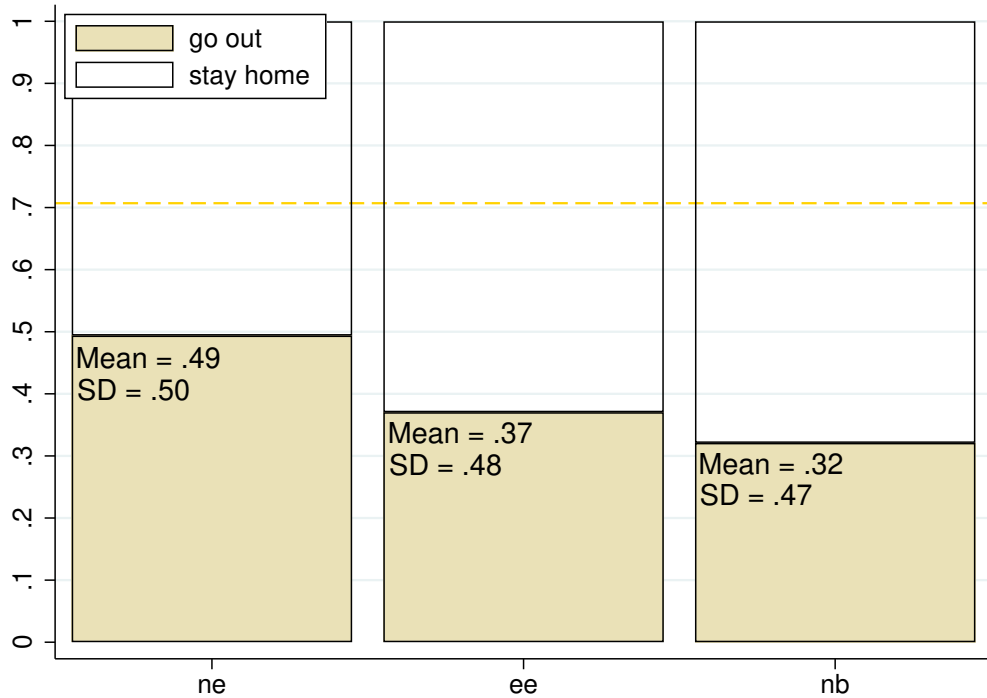


FIGURE 3: Mean and Standard Deviation refers to *go* values, i.e., the proportion of subjects choosing to go out. The gold dashed line represents the mixed-strategy Nash equilibrium, i.e., the probability of playing *go*.

Concerning RQ.2, we analyze decisions in the EFBG of S1 conditional on the elicited subjective norms. To this purpose, we consider a dichotomous variable *EFBG_1* that takes a value of 0 when the subject decides to stay home and 1 when she decides to go out. The top-left panel of Figure 4 shows the proportion of subjects choosing to stay home/go out, conditional on their participation in either the elicitation of *ee* or of *ne* and *nb* and compared with average choices the Baseline of S2. All three levels are lower than the MSNE and do not differ significantly across conditions ($\chi^2(2) = 1.168$, $p = 0.558$). On the contrary, we do observe differences when the decision in the EFBG is conditional not only on the type of elicitation but also on the specific answer subjects gave, i.e. stay home or go out. In the top-right panel of Figure 4, we compare the proportions of subjects opting to stay home/go out conditional on each specific answer to the elicitation of *ee*. It is clearly shown that the proportion of subjects opting to go out is much lower for the 102 subjects who hold “go out” as their empirical expectation compared to the 60 who hold “stay home” ($\chi^2(1) = 54.451$, $p < 0.001$). The bottom-right panel of Figure 4 shows EFBG choices conditional on *ne* elicitation answers. Here, the proportion of subjects opting to go out is still lower for the 80 subjects who indicated “go out” as their normative expectation compared to the 82 who opted for “stay home”, with an almost significant difference ($\chi^2(1) = 2.978$, $p = 0.084$). In the bottom-left panel, we present EFBG decisions conditional on the *nb* normative preference. The observed pattern here closely resembles the one in decisions conditioned on *ee*, with a significant difference between the two *EFBG_1* averages from the S2 subjects who indicated “go out” as their normative belief and the 110 who opted for “stay home” ($\chi^2(1) = 67.947$, $p < 0.001$).

In Table 2, we compare the average *EFBG_1* decisions made in the baseline in S2 with those made in S1, taking into account the social expectations and normative beliefs that subjects indicated before making such decisions. While the average *EFBG_1* decisions of subjects who indicated “stay home” as *ee* or *nb* are both significantly below the baseline level ($\chi^2(1) = 17.880$, $p < 0.001$; and $\chi^2(1) = 25.245$, $p < 0.001$ respectively), the opposite holds true for those who indicated “go out” ($\chi^2(1) = 26.707$, $p < 0.001$; and $\chi^2(1) = 30.801$, $p < 0.001$ respectively). In the case of subjects choosing either “stay home” or “go out” as their *ne*, the *EFBG_1* levels are similar to the baseline average ($\chi^2(1) = 3.678$, $p = 0.055$ and $\chi^2(1) = 0.068$, $p = 0.795$, respectively).¹⁰ Notably, the comprehensive comparison between the evidence from S1 and the baseline in S2 highlights that the content of the elicitation, rather than its type, plays a crucial role. Specifically, subjects’ decisions in the EFBG are not significantly influenced by the elicitation process itself, i.e., when comparing the elicitation of *ee/ne* with the baseline. However, substantial differences emerge when examining EFBG decisions that are contingent upon the choices made in response to *ee* and *nb*. This suggests that decisions in the EFBG, when conditioned on *ee/nb/ne*, genuinely reflect the connection between choices in the anti-coordination

¹⁰To address the issue of multiple hypothesis testing, we employ the false discovery rate procedure (Benjamini & Hochberg, 1995; Simes, 1986). The adjusted p-values are then presented in Appendix D. Our results are robust to these corrections.

problem and the personal and (perceived) social norms we measure. However, it is important to note that our design does not allow us to detect mutual influence between subjects' decisions in the EFBG and what they indicate as their social expectations and normative beliefs.

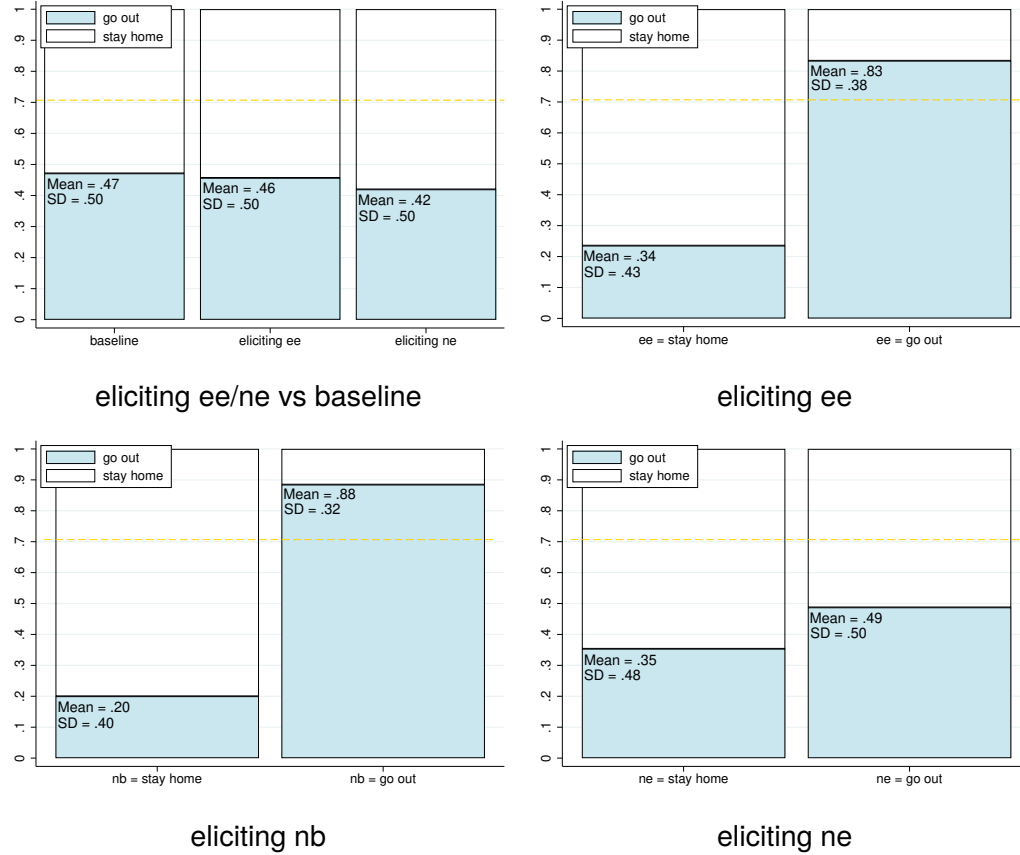


FIGURE 4: Mean and Standard Deviation refers to *go* values, i.e., the proportion of subjects choosing to go out. The gold dashed line represents the mixed-strategy Nash equilibrium, i.e., the probability of playing *go*.

TABLE 2: EFBG 1, decisions in S1

AVERAGE GO OUT	ee		nb		ne	
	<i>sh</i>	<i>go</i>	<i>sh</i>	<i>go</i>	<i>sh</i>	<i>go</i>
	(0.24)[60]	(0.83)[102]	(0.20)[110]	(0.89)[52]	(0.35)[82]	(0.49)[80]
baseline (0.47)[331]	p<0.001	p<0.001	p<0.001	p<0.001	p=0.055	p=0.795

Notes:

The dependent variable is the frequency of subjects playing “go out”.

Means are in parentheses, number of observations is in brackets.

P-values of the pairwise comparisons are based on Pearson χ^2 .

Evidence 2 *Subjects tend to comply with the perceived descriptive norm they hold and stay home (go out) when they expect that the majority of others stay home (go out). Subjects do not condition their behavior on perceived injunctive norms, albeit they tend to comply with their own personal norm.*

To address RQ.3, we consider average decisions in the first EFBG decision of S2 (Figure 5) – as measured by the dichotomous variable *EFBG_1* that takes a value of 0 when the subject decides to stay home and 1 when she decides to go out – and conduct a between-treatment analysis. Accordingly, we conduct a series of non-parametric tests, which are reported in Table 3. We preliminary conduct a chi-square test across all five treatments (baseline, *ee_sh*, *ee_go*, *ne_sh*, and *ne_go*), which revealed a significant overall difference ($\chi^2(4) = 12.8073$, $p = 0.012$). As concerning the test of the differences, the first row of the table compares the EFBG choices made in the primed treatments with those made in the Baseline. We find that the proportion of subjects choosing to go out is significantly lower in *ee_go* and *ne_sh* compared to the baseline. ($\chi^2(1) = 4.727$, $p = 0.030$ and $\chi^2(1) = 6.067$, $p = 0.014$ respectively), while it did not differ significantly in the *ee_sh* ($\chi^2(1) = 0.528$, $p = 0.468$) and *ne_go* ($\chi^2(1) = 1.844$, $p = 0.174$). The other rows report the comparisons across primed treatments. We find that *ee_sh* had the highest proportion, which is significantly greater than both *ee_go* ($\chi^2(1) = 6.265$, $p = 0.012$) and *ne_sh* ($\chi^2(1) = 7.586$, $p = 0.006$), and almost significantly greater than *ne_go* ($\chi^2(1) = 3.225$, $p = 0.073$). We observe no significant differences when comparing *ee_go* with *ne_sh* ($\chi^2(1) = 0.069$, $p = 0.792$) and *ne_go* ($\chi^2(1) = 0.495$, $p = 0.482$), or when comparing *ne_sh* with *ne_go* ($\chi^2(1) = 0.929$, $p = 0.335$).¹¹ To corroborate the robustness of our results, we present a regression analysis in Appendix C. Despite the presence of heterogeneity in subjects' ages and willingness to take risks within our samples, our findings remain robust even when considering these variables as regressors. Notably, the regressions also reveal a positive association between higher levels of willingness to take risks and the preference for going out. This result might be driven by the framing of our decision task, which – as underlined in the Method section – makes an uncertainty aspect more salient with respect to the Volunteer's dilemma framing.

¹¹In Appendix D, we present the adjusted p-values computed through the false discovery rate procedure (Benjamini & Hochberg, 1995; Simes, 1986). Also in the case of S2, results are robust to these adjustments.

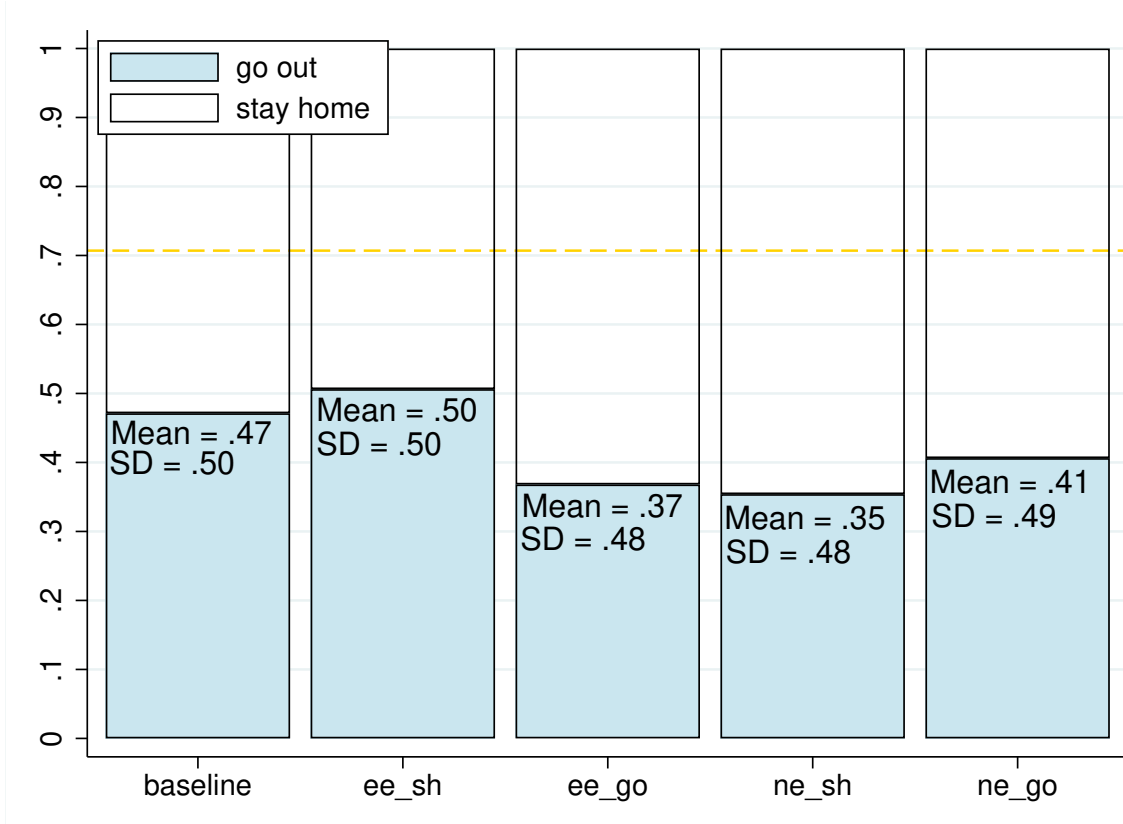


FIGURE 5: Mean and Standard Deviation refers to *go* values, i.e., the proportion of subjects choosing to go out. The gold dashed line represents the mixed-strategy Nash equilibrium, i.e., the probability of playing *go*.

Evidence 3 *Priming with social expectations never increases the share of subjects going out. Subjects tend to use strategically the information about the injunctive norm and reduce their going out when they are told that the majority is expected to go out. They comply with the rule of behavior dictated by injunctive norm only in case they are told that the majority believes that staying home is what one ought to do.*

RQ.4 will be addressed by referring to the variable *switching* which is a dichotomous equal to 1 when *EFBG_1* is different from *EFBG_2*, where the latter is the dichotomous for subjects' decision in the EFBG in the second part of S2. Figure 6 displays the frequency of decision changes between the two parts across all treatments, regardless of the choice made in the first part. In this analysis, we utilize the above-introduced notation for treatments based on the priming and separate the priming in the first part from the one in the second using an "&" symbol. On average, we observe that subjects switch their decisions approximately 22% of the time. However, we did not find any significant differences in the rate of switching across treatments ($\chi^2(11) = 4.859$, $p = 0.938$). Consequently, no difference is detected also in the comparisons between each primed treatment and the baseline. The last evidence summarises this null-result:

TABLE 3: EFBG 1, priming with social expectations

AVERAGE GO OUT	ee_sh	ee_go	ne_sh	ne_go
baseline (47.13)[331]	0.468	0.030**	0.014**	0.174
ee_sh (50.63)[160]		0.012**	0.006***	0.073*
ee_go (36.81)[163]			0.792	0.482
ne_sh (35.40)[161]				0.335
ne_go (40.63)[160]				
OVERALL	0.012**			

Notes:

The dependent variable is the frequency of subjects playing “go out”.
Means are in parentheses, number of observations is in brackets.
P-values of the pairwise comparisons are based on Pearson χ^2 .

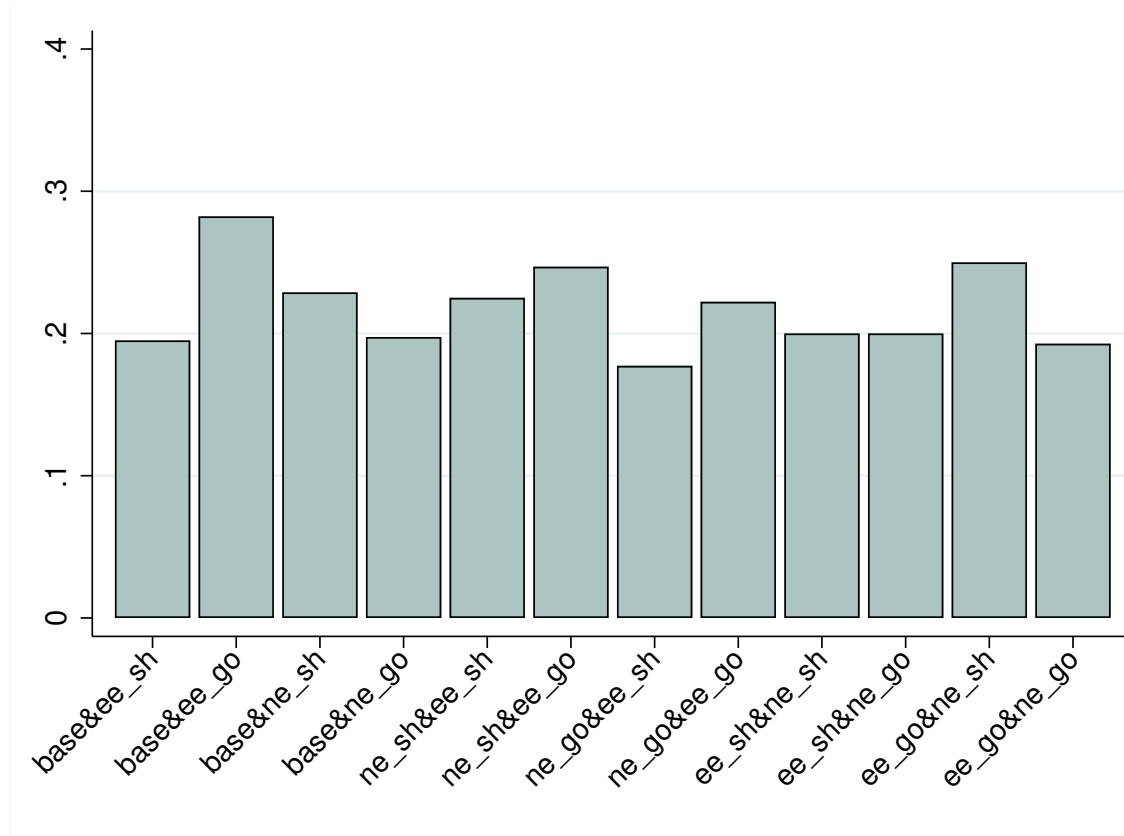


FIGURE 6: Switching dichotomous equal to 1 when individual EFBG decisions differ between the two rounds.

Evidence 4 *There is a low share of subjects who changes behavior but this does not depend on primings. Consistency between primings does not produce a lower rate of change than inconsistency.*

4 Discussion

In an online experiment, we investigate the influence of normative preferences and social expectations on an anti-coordination decision, such as the choice between staying home or going out in the El Farol Bar Game. We have conducted two interconnected studies: in the first study, we independently elicited empirical and normative expectations from subjects using a method inspired by Bicchieri & Chavez (2010) before having them play a one-shot El Farol Bar Game. In the second study, subjects played two one-shot El Farol Bar Game, with different social expectation primes, but without feedback in between.

Our findings show that most subjects believe staying home is the right thing to do and tend to follow their normative beliefs accordingly. However, there is no prevailing consensus regarding what others believe is normatively right (normative expectation), and subjects do not tend to base their decisions on these expectations. On the other hand, a significant majority of subjects expects that the predominant behavior is staying home (empirical expectations), while subjects tend to conform to their empirical expectation regardless of the content. Overall, our interpretation of the evidence from Study 1 posits that in our El Farol Bar Game setting subjects tend to comply with the descriptive norm they perceive and follow their personal norm. However, more than one norm is perceived and becomes effective in conditioning behavior in our population, and indeed the two behavioral tendencies balance each other. Indeed, we do not observe a dominant behavior in the Study 1 sample, as compared to the baseline of Study 2 where no elicitation, nor priming were implemented.

Interestingly, priming with social expectations affects EFBG decisions, albeit only in the direction of a lower share of subjects risking a higher payoff and going out. Indeed, only two kinds of primes make subjects more likely to stay home: a) the descriptive norm for which the majority goes out and b) the injunctive norm indicating that staying home is commonly believed as the right thing to do. Overall, our interpretation of the evidence from Study 2 posits that information about the descriptive norm is used in a strategic way to avoid congestion, while an exogenously provided injunctive norm of prudence or altruism can induce compliance. Furthermore, these effects are relatively stable, as we observe that the rate of change in behavior between the two rounds is relatively low and is not dependent on the specific information provided and on their (in)consistency.

Our contribution proposes a test for theories of social norms challenged by the structure of payoffs and the framing of the El Farol Bar Game. Specifically, we address some assumptions concerning the interplay and behavioral impacts of empirical and normative expectations underlying Cristina Bicchieri's theory of social norms. Although her theory

consistently applies to decision contexts where there is no strategic interaction – such as the dictator game (Bicchieri & Xiao, 2009) – the complexity of anti-coordination problems, such as the El Farol Bar game, poses peculiar difficulties. Indeed, in these strategic interactions, the coexistence of asymmetric multiple equilibria and the relevance of potentially various moral or social values make both the determination of social expectations and their use in the decision process not straightforward for subjects. While our findings substantially confirm the prevalence of empirical over normative expectations in the case of difference between the two, a new and autonomous role for personal normative beliefs emerges. This role might be connected to the irrelevance of normative expectations due to the complexities involved in this decision context.

This aspect would deserve further research to overcome the limitations intrinsic to the circumstance that the elicitation of personal normative beliefs is not incentivizable. Moreover, although we base our measurement on a well-established methodology, it must be observed that the elicitation of personal norms may be conditioned by the linguistic formulation through which they are revealed, as the literature on language-based preferences would suggest (Capraro et al., 2022). Furthermore, although we base our analysis on comparisons between treatments, we can not rule out the possibility that both the elicited norms and their impact on decisions are specific to the parameters we adopted in our version of the El Farol Bar Game. In other words, further research varying the relative magnitudes of stakes, the group size, and the framing of the context of the decision would be needed to verify the robustness of our results and their generalizability to other anti-coordination problems.

Acknowledgements

The paper has benefited from comments by participants at the 2022 Norms and Behavioral Change (NOBEC) Conference (University of Pennsylvania, USA), the Seventh meeting of the Behavioral and Experimental Economics Network (BEEN) 2022 Workshop (IMT Lucca, Italy), the Italian Society of Law and Economics (SIDE) 2022 Conference (LUMSA University in Palermo, Italy), the Seventh International Meeting on Experimental and Behavioral Social Sciences (IMEBESS) 2023 Conference (Lisbon School of Economics and Management, Portugal), the Italian Society of Public Economics (SIEP) 2023 Conference (University of Verona, Italy). The usual disclaimer applies.

References

- Agerström, J., Carlsson, R., Nicklasson, L., & Guntell, L. (2016). Using descriptive social norms to increase charitable giving: The power of local norms. *Journal of Economic Psychology*, 52, 147–153.
- Alekseev, A., Charness, G., & Gneezy, U. (2017). Experimental methods: When and why contextual instructions are important. *Journal of Economic Behavior & Organization*, 134, 48–59.
- Arechar, A. A., Gächter, S., & Molleman, L. (2018). Conducting interactive experiments online. *Experimental economics*, 21, 99–131.
- Arthur, W. B. (1994). Inductive reasoning and bounded rationality. *The American economic review*, 84(2), 406–411.
- Baron, J. & Goodwin, G. P. (2020). Consequences, norms, and inaction: A comment. *Judgment and Decision Making*, 15(3), 421–442.
- Baron, J. & Goodwin, G. P. (2021). Consequences, norms, and inaction: Response to Gawronski et al. (2020). *Judgment and Decision Making*, 16(2), 566–595.
- Baron, J. & Gürçay, B. (2017). A meta-analysis of response-time tests of the sequential two-systems model of moral judgment. *Memory & Cognition*, 45(4), 566–575.
- Bašić, Z. & Verrina, E. (2021). Personal norms—and not only social norms—shape economic behavior. *MPI Collective Goods Discussion Paper*, (2020/25).
- Bavel, J. J. V., et al. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature human behaviour*, 4(5), 460–471.
- Benjamini, Y. & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal statistical society: series B (Methodological)*, 57(1), 289–300.
- Bicchieri, C. (2005). *The grammar of society: The nature and dynamics of social norms*. Cambridge University Press.
- Bicchieri, C. (2016). *Norms in the wild: How to diagnose, measure, and change social norms*. Oxford University Press.
- Bicchieri, C. & Chavez, A. (2010). Behaving as expected: Public information and fairness norms. *Journal of Behavioral Decision Making*, 23(2), 161–178.
- Bicchieri, C. & Dimant, E. (2022). Nudging with care: The risks and benefits of social information. *Public choice*, 191(3-4), 443–464.

- Bicchieri, C., Dimant, E., Gächter, S., & Nosenzo, D. (2022). Social proximity and the erosion of norm compliance. *Games and Economic Behavior*, 132, 59–72.
- Bicchieri, C., et al. (2021). In science we (should) trust: Expectations and compliance across nine countries during the COVID-19 pandemic. *PloS one*, 16(6), e0252892.
- Bicchieri, C. & Xiao, E. (2009). Do the right thing: but only if others do so. *Journal of Behavioral Decision Making*, 22(2), 191–208.
- Biel, A. & Thøgersen, J. (2007). Activation of social norms in social dilemmas: A review of the evidence and reflections on the implications for environmental behaviour. *Journal of economic psychology*, 28(1), 93–112.
- Blanco, M., Engelmann, D., Koch, A. K., & Normann, H.-T. (2010). Belief elicitation in experiments: is there a hedging problem? *Experimental Economics*, 13(4), 412–438.
- Bonan, J., Cattaneo, C., d’Adda, G., & Tavoni, M. (2020). The interaction of descriptive and injunctive social norms in promoting energy conservation. *Nature Energy*, 5(11), 900–909.
- Bottazzi, G. & Devetag, G. (2007). Competition and coordination in experimental minority games. *Journal of Evolutionary Economics*, 17, 241–275.
- Camerer, C. F., Ho, T.-H., & Chong, J.-K. (2004). A cognitive hierarchy model of games. *The Quarterly Journal of Economics*, 119(3), 861–898.
- Campigotto, N., Catola, M., D’Alessandro, S., Guarnieri, P., & Spadoni, L. (2023). Curbing Energy Consumption through Voluntary Quotas: Experimental Evidence. *Available at SSRN 4500017*.
- Capraro, V., Halpern, J. Y., & Perc, M. (2022). From outcome-based to language-based preferences. *Journal of Economic Literature (Forthcoming)*.
- Capraro, V. & Rand, D. G. (2018). Do the Right Thing: Experimental evidence that preferences for moral behavior, rather than equity or efficiency per se, drive human prosociality. *Judgment and Decision Making*, 13(1), 99–111.
- Catola, M., D’Alessandro, S., Guarnieri, P., Pizziol, V., et al. (2021a). *Personal and social norms in a multilevel public goods experiment*. Università di Pisa, Dipartimento di Economia e Management.
- Catola, M., D’Alessandro, S., Guarnieri, P., & Pizziol, V. (2021b). Personal norms in the online public good game. *Economics Letters*, 207, 110024.

- Chen, D. L., Schonger, M., & Wickens, C. (2016). oTree-An open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance*, 9, 88–97.
- Cialdini, R. B., Demaine, L. J., Sagarin, B. J., Barrett, D. W., Rhoads, K., & Winter, P. L. (2006). Managing social norms for persuasive impact. *Social influence*, 1(1), 3–15.
- Cialdini, R. B. & Jacobson, R. P. (2021). Influences of social norms on climate change-related behaviors. *Current Opinion in Behavioral Sciences*, 42, 1–8.
- Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. In *Advances in experimental social psychology*, volume 24 (pp. 201–234). Elsevier.
- Diekmann, A. (1985). Volunteer’s dilemma. *Journal of conflict resolution*, 29(4), 605–610.
- Diekmann, A. & Przepiorka, W. (2016). “Take one for the team!” individual heterogeneity and the emergence of latent norms in a volunteer’s dilemma. *Social Forces*, 94(3), 1309–1333.
- Dimant, E. (2023). Beyond average: A method for measuring the tightness, looseness, and polarization of social norms. *Economics Letters*, 233, 111417.
- Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3), 522–550.
- Erev, I. & Rapoport, A. (1998). Coordination, “magic,” and reinforcement learning in a market entry game. *Games and economic behavior*, 23(2), 146–175.
- Falk, A., Becker, A., Dohmen, T., Huffman, D., & Sunde, U. (2023). The preference survey module: A validated instrument for measuring risk, time, and social preferences. *Management Science*, 69(4), 1935–1950.
- Fallucchi, F. & Nosenzo, D. (2022). The coordinating power of social norms. *Experimental Economics*, 25(1), 1–25.
- Farrow, K., Grolleau, G., & Ibanez, L. (2017). Social norms and pro-environmental behavior: A review of the evidence. *Ecological Economics*, 140, 1–13.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, 41(4), 1149–1160.
- Fehr, E. & Fischbacher, U. (2004). Social norms and human cooperation. *Trends in cognitive sciences*, 8(4), 185–190.

- Fehr, E. & Schurtenberger, I. (2018). Normative foundations of human cooperation. *Nature human behaviour*, 2(7), 458–468.
- Felsen, G., Castelo, N., & Reiner, P. B. (2013). Decisional enhancement and autonomy: public attitudes towards overt and covert nudges. *Judgment and Decision making*, 8(3), 202–213.
- Forsyth, D. R. (2020). Group-level resistance to health mandates during the COVID-19 pandemic: A groupthink approach. *Group Dynamics: Theory, Research, and Practice*, 24(3), 139.
- Fritz, C. O., Morris, P. E., & Richler, J. J. (2012). Effect size estimates: current use, calculations, and interpretation. *Journal of experimental psychology: General*, 141(1), 2.
- Gächter, S., Nosenzo, D., & Sefton, M. (2013). Peer effects in pro-social behavior: Social norms or social preferences? *Journal of the European Economic Association*, 11(3), 548–573.
- Gawronski, B., Armstrong, J., Conway, P., Friesdorf, R., & Hütter, M. (2017). Consequences, norms, and generalized inaction in moral dilemmas: The CNI model of moral decision-making. *Journal of Personality and Social Psychology*, 113(3), 343–376.
- Gawronski, B., Conway, P., Hütter, M., Luke, D. M., Armstrong, J., & Friesdorf, R. (2020). On the validity of the CNI model of moral decision-making: Reply to Baron and Goodwin (2020). *Judgment & Decision Making*, 15(6).
- Gintis, H. (2009). *Game theory evolving*. Princeton university press.
- Goeree, J. K., Holt, C. A., & Smith, A. M. (2017). An experimental examination of the volunteer's dilemma. *Games and Economic Behavior*, 102, 303–315.
- House, B. R. (2018). How do social norms influence prosocial development? *Current Opinion in Psychology*, 20, 87–91.
- Iida, Y., Akiyama, T., & Uchida, T. (1992). Experimental analysis of dynamic route choice behavior. *Transportation Research Part B: Methodological*, 26(1), 17–32.
- Kallgren, C. A., Reno, R. R., & Cialdini, R. B. (2000). A focus theory of normative conduct: When norms do and do not affect behavior. *Personality and social psychology bulletin*, 26(8), 1002–1012.
- Kets, W. (2012). Learning with fixed rules: The minority game. *Journal of Economic Surveys*, 26(5), 865–878.

- Knorr, F., Chmura, T., & Schreckenberg, M. (2014). Route choice in the presence of a toll road: The role of pre-trip information and learning. *Transportation Research Part F: Traffic Psychology and Behaviour*, 27, 44–55.
- Kopányi-Peuker, A. (2019). Yes, I'll do it: A large-scale experiment on the volunteer's dilemma. *Journal of Behavioral and Experimental Economics*, 80, 211–218.
- Kraft-Todd, G., Yoeli, E., Bhanot, S., & Rand, D. (2015). Promoting cooperation in the field. *Current Opinion in Behavioral Sciences*, 3, 96–101.
- Krupka, E. L., Weber, R., Crosno, R. T., & Hoover, H. (2022). “When in Rome”: Identifying social norms using coordination games. *Judgment and Decision Making*, 17(2), 263–283.
- Krupka, E. L. & Weber, R. A. (2013). Identifying social norms using coordination games: Why does dictator game sharing vary? *Journal of the European Economic Association*, 11(3), 495–524.
- Ledy, J. R. (2007). If nobody is going there anymore because it's too crowded, then who is going? Experimental Evidence of Learning and Imitation in the El Farol Coordination Game. *Experimental Evidence of Learning And Imitation in the El Farol Coordination Game (August 21, 2007)*.
- Linde, J., Sonnemans, J., & Tuinstra, J. (2014). Strategies and evolution in the minority game: A multi-round strategy experiment. *Games and economic behavior*, 86, 77–95.
- Macy, J. T., Owens, C., Mullis, K., & Middlestadt, S. E. (2021). The role of self-efficacy and injunctive norms in helping older adults decide to stay home during the COVID-19 pandemic. *Frontiers in Public Health*, 9, 660813.
- McGuire, L., Farooq, A., & Rutland, A. (2023). Adolescents' social and moral reasoning about COVID-19 public health behaviors. *Journal of Applied Developmental Psychology*, 85, 101515.
- Muldoon, R., Lisciandra, C., Bicchieri, C., Hartmann, S., & Sprenger, J. (2014). On the emergence of descriptive norms. *Politics, philosophy & economics*, 13(1), 3–22.
- Neville, F. G., Templeton, A., Smith, J. R., & Louis, W. R. (2021). Social norms, social identities and the COVID-19 pandemic: Theory and recommendations. *Social and Personality Psychology Compass*, 15(5), e12596.
- Palan, S. & Schitter, C. (2018). Prolific. ac—A subject pool for online experiments. *Journal of Behavioral and Experimental Finance*, 17, 22–27.
- Peysakhovich, A. & Rand, D. G. (2016). Habits of virtue: Creating norms of cooperation and defection in the laboratory. *Management Science*, 62(3), 631–647.

- Rapoport, A., Seale, D. A., Erev, I., & Sundali, J. A. (1998). Equilibrium play in large group market entry games. *Management Science*, 44(1), 119–141.
- Reid, A. E., Cialdini, R. B., & Aiken, L. S. (2010). Social norms and health behavior. *Handbook of behavioral medicine: Methods and applications*, (pp. 263–274).
- Reno, R. R., Cialdini, R. B., & Kallgren, C. A. (1993). The transsituational influence of social norms. *Journal of personality and social psychology*, 64(1), 104.
- Ruggeri, K., et al. (2023). A synthesis of evidence for policy from behavioural science during COVID-19. *Nature*, (pp. 1–14).
- Sargent, R. H. & Newman, L. S. (2021). Pluralistic ignorance research in psychology: A scoping review of topic and method variation and directions for future research. *Review of General Psychology*, 25(2), 163–184.
- Schmelz, K. & Bowles, S. (2021). Overcoming COVID-19 vaccination resistance when alternative policies affect the dynamics of conformism, social norms, and crowding out. *Proceedings of the National Academy of Sciences*, 118(25), e2104912118.
- Schram, A., Di Zheng, J., & Zhuravleva, T. (2022). Corruption: A cross-country comparison of contagion and conformism. *Journal of Economic Behavior & Organization*, 193, 497–518.
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological science*, 18(5), 429–434.
- Selten, R., Chmura, T., Pitz, T., Kube, S., & Schreckenberg, M. (2007). Commuters route choice behaviour. *Games and Economic Behavior*, 58(2), 394–406.
- Simes, R. J. (1986). An improved Bonferroni procedure for multiple tests of significance. *Biometrika*, 73(3), 751–754.
- Smerdon, D., Offerman, T., & Gneezy, U. (2020). ‘Everybody’s doing it’: On the persistence of bad social norms. *Experimental Economics*, 23, 392–420.
- te Velde, V. L. & Louis, W. (2022). Conformity to descriptive norms. *Journal of Economic Behavior & Organization*, 200, 204–222.
- Thøgersen, J. (2008). Social norms and cooperation in real-life social dilemmas. *Journal of economic psychology*, 29(4), 458–472.
- Zhang, S., Wang, Y., & Wei, Y. (2022). Follow or not? Descriptive norms and public health compliance: Mediating role of risk perception and moderating effect of behavioral visibility. *Frontiers in Psychology*, 13, 1040218.

Zou, X. & Savani, K. (2019). Descriptive norms for me, injunctive norms for you: Using norms to explain the risk gap. *Judgment and Decision Making*, 14(6), 644–648.

Appendix

Appendix A: Frequencies of sub-session

In Table 4, we present the frequencies of the independent sub-sessions, each consisting of 9 subjects, ending up with a majority for either “stay home” or “go out” in both social expectations. We observed that a majority was present for each combination, enabling us to prime subjects in Study 2 with all possible combinations of expectations. To ensure that subjects in Study 1 formed independent groups of 9, we allowed the first subject of one group to enter only once the last subject of the previous group left the experiment.

TABLE 4: The frequencies of sub-sessions with a majority for each choice based on the corresponding social expectation.

EXPECTATION/CHOICE	stay home	go out		
	<i>frequencies</i>		<i>tot</i>	<i>n</i>
empirical expectation	16	2	18	162
normative expectation	8	10	18	162

Notes.

Independent sub-sessions of 9. *n* is the number of subjects.

Appendix B: Dropouts statistics

TABLE 5: Frequency of (No) Dropping Out Subjects

treatment	dropout	
	No	Yes
s1_ee	162	1
s1_ne	162	2
s2_baseline	331	0
s2_ee_sh	160	2
s2_ee_go	163	0
s2_ne_sh	161	0
s2_ne_go	160	2
Total	1299	7

Notes.

Subjects are considered as having dropped out if they left the experiment after providing consent.

Appendix C: Socio-demographic characteristics

TABLE 6: Differences across studies and treatments of socio-demographic characteristics and self-assessed measures

<i>Variable</i>	<i>Test</i>	<i>p</i> (by study)	<i>p</i> (by treatment)
Age	Kruskal-Wallis	< 0.001	0.003
Female	χ^2	0.942	0.488
Christian	χ^2	0.610	0.933
Student	χ^2	0.377	0.587
Self Risk	Kruskal-Wallis	0.017	0.042
Donate	Kruskal-Wallis	0.852	0.368

Notes.

Age: integer number. *Female*: 1 if female; 0 if male. *Christian*: 1 if Christian; 0 if not. *Student*: 1 if student; 0 if not. *Self Risk*: self-assessed willingness to take risk (Dohmen et al., 2011). *Donate*: self-assessed willingness to donate (Falk et al., 2023). The third and the fourth column list respectively the probabilities, p , of having a different distribution across the 2 studies and across the 7 experimental treatments with respect to the tests indicated in the second column.

TABLE 7: Probit regressions with socio-demographic characteristics

DV: EFBG_1		
	(1)	(2)
S1		0.044 (0.086)
baseline omitted:		
▷ S1_ee	-0.106 (0.127)	
▷ S1_ne	-0.189 (0.129)	
▷ S2_ee_sh	0.080 (0.127)	
▷ S2_ee_go	-0.333*** (0.127)	
▷ S2_ne_sh	-0.257** (0.129)	
▷ S2_ne_go	-0.113 (0.128)	
Age	0.009 (0.007)	0.009 (0.007)
Female	0.123 (0.077)	0.124 (0.077)
Christian	0.155* (0.089)	0.152* (0.089)
Student	-0.026 (0.106)	-0.019 (0.106)
Self Risk	0.234*** (0.018)	0.233*** (0.018)
Donate	-0.001 (< 0.001)	-0.001* (< 0.001)
<i>N</i>	1298	1298

Notes.

One observation was excluded due to the absence of provided socio-demographic characteristics.

Dependent variable. *EFBG_1*: 1 if go out; 0 if stay home. Regressors. *S1*: 1 if Study 1; 0 if Study 2. *Age*: integer number *Female*: 1 if female; 0 if male. *Christian*: 1 if Christian; 0 if not. *Student*: 1 if student; 0 if not. *Self Risk*: self-assessed willingness to take risk (Dohmen et al., 2011). *Self Risk*: self-assessed willingness to donate (Falk et al., 2023).

Standard errors are in parentheses. Significance of coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix D: Multiple Hypotheses Testing

TABLE 8: EFBG_1, tests of hypotheses adjusted for multiple hypothesis testing using Benjamini and Hochberg (1995)

AVERAGE GO OUT	ee		nb		ne	
	<i>sh</i> (0.24)[60]	<i>go</i> (0.83)[102]	<i>sh</i> (0.20)[110]	<i>go</i> (0.89)[52]	<i>sh</i> (0.35)[82]	<i>go</i> (0.49)[80]
baseline (0.47)[331]	p<0.001	p<0.001	p<0.001	p<0.001	p=0.066	p=0.795

dependent variable is the frequency of subjects playing “go out”.
means are in parentheses, number of observations is in brackets.

TABLE 9: EFBG_1, tests of hypotheses adjusted for multiple hypothesis testing using Benjamini and Hochberg (1995)

TREATMENT	ee_sh	ee_go	ne_sh	ne_go
baseline (47.13)[331]	0.536	0.075*	0.047**	0.290
ee_sh (50.63)[160]		0.047**	0.047**	0.146*
ee_go (36.81)[163]			0.792	0.536
ne_sh (35.40)[161]				0.479
ne_go (40.63)[160]				

Notes.

Dependent variable is the frequency of subjects playing “go out”.
Means are in parentheses, number of observations is in brackets.