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# 'Everybody's Doing It': On the Persistence of Bad Social Norms

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**Abstract** We investigate how information about the preferences of others affects the persistence of 'bad' social norms. One view is that bad norms thrive even when people are informed of the preferences of others, since the bad norm is an equilibrium of a coordination game. The other view is based on pluralistic ignorance, in which uncertainty about others' preferences is crucial. In an experiment, we find clear support for the pluralistic ignorance perspective. In addition, the strength of social interactions is important for a bad norm to persist. These findings help in understanding the causes of such bad norms, and in designing interventions to change them.

**Keywords** Social norms · Pluralistic ignorance · Social interactions · Equilibrium selection · Conformity

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## 1 Introduction

Social norms provide informal rules that govern our actions within different groups and societies and across all manner of situations. Many social norms develop in order to overcome market failure, mitigate negative externalities or promote positive ones so as to facilitate some collective goal (Arrow 1970; Hechter and Opp 2001). However, social norms that are inefficient from a welfare perspective also persist in the real world. Many historical norms, such as the custom of dueling in the American South (Lessig 1995) and a millennium of female foot-binding in China (Mackie 1996), have proven extremely resilient to change. In modern times, bad social norms play an important role in many topical policy issues, such as in environmental policy (Kinzig et al 2013; Zeppini 2015), human rights reform (Prentice 2012) and female genital mutilation (Platteau et al 2017), and in many development economics issues, such as income inequality (Singh and Dhumale 2000), population growth (Munshi and Myaux 2006), and HIV/AIDS (Young et al 2010).

A key feature of a social norm is the desire to conform to the majority in a group. We follow Bicchieri (2017, p.35), who defines a social norm as a “rule of behavior such that individuals prefer to conform to it on condition that they believe that (a) most people in their relevant network conform to it (empirical expectation), and (b) most people in their relevant network believe they ought to conform to it (normative expectation) and may sanction deviations.”

In this paper, we investigate the conditions under which bad norms emerge and thrive. We conjecture that bad norms initially emerge as good norms, but changing conditions over time alter the payoff structure such that the norm not only ceases to solve negative externalities, but actually begins to promote them. The most important contribution of our paper is that we investigate the extent to which a lack of information about others’ preferences or attitudes is important for the development of bad social norms. In particular, we provide evidence that compares two predominant but opposing views on how information about others’ preferences shapes bad norms.

One perspective is that bad norms can thrive independent of whether or not people are informed of the preferences of others. This view is supported by the model of Brock and Durlauf (2001), whose approach we use to study the development of norms.[1] They propose a stationary coordination game in which agents are driven by a taste for conformity. All other things equal, agents benefit when more people make the same choice as they do. In equilibrium, players either coordinate on the welfare-maximizing allocation or on a welfare-inefficient allocation. We extend their approach by allowing players to be uncertain about the preferences of others, and by allowing preferences to change over time. We introduce a simple belief formation procedure that assumes that agents base their beliefs on the norm in the previous round and

[1] Recent alternative approaches to modeling social norms include Michaeli and Spiro (2017), who focus on pairwise interactions in a coordination game, Acemoglu and Jackson (2015), who investigate an intergenerational context, and Platteau et al (2017), who investigate various norm approaches to the application of female genital mutilation.

on their preference, which is known to correlate with the preferences of others. This procedure allows us to generate predictions about when a society will continue to play according to an equilibrium after it has turned from a good to a bad one.[2] Essentially, these predictions do not depend on the information that players have about others' preferences.

The alternative view is that bad norms are driven by *pluralistic ignorance*. Pluralistic ignorance refers to a situation in which most individuals have private attitudes and judgments that differ from the prevailing norm, and wrongly believe that the majority of group members have a private preference to keep to the status quo (Miller and McFarland 1987; Prentice and Miller 1996). As a result, a bad norm may persist even though the majority of the group would like to change it. Pluralistic ignorance has been linked to the propagation of various damaging social issues, such as college binge-drinking (**?**), tax avoidance (Wenzel 2005), school bullying (Sandstrom et al 2013) and the spread of HIV/AIDS due to stigmas against condom usage (Gage 1998). Notice that in this approach, the uncertainty about other individuals' preferences is a key ingredient for the emergence and persistence of bad social norms.

We use the model of Brock and Durlauf (2001) to design an experiment that allows us to investigate the role that information about others' preferences plays for the development of bad norms, thus incorporating the insights from the pluralistic ignorance viewpoint. In our experiment, we monetarize social payoffs as a convenient way to test the model's predictions.[3] In a setup with

[2] By way of a practical example, consider handshaking, which US President Donald Trump has called "one of the curses of American society". Shaking hands as a form of greeting is believed to have originated around 2,000 years ago between opposing military personnel (D'Cruz 2005). It served as a signaling mechanism that the offeror was not concealing a weapon. Particularly during wartime in medieval societies, the small personal effort of the physical act was easily outweighed by the mutual benefits of ensuring peaceful discourse. The custom spread and today has become a very strong social norm in Western culture that may lead to significant social sanctions if defied, although sending a signal that an individual is unarmed is no longer applicable. However, hand-to-hand contact is also recognized as one of the main channels for common infections; the H1N1 epidemic of 2009 led many school administrators in the United States to ban handshaking at graduation ceremonies in that year, and more recent influenza scares prompted the 2012 British Olympic team to shun this standard act of sportsmanship before events (Neyfakh 2013). Yet, despite these isolated instances of imposed non-conformity and the efforts of small activist groups such as the website `www.StopHandshaking.com`, the norm remains a bastion of modern etiquette, and deviations from the norm tend to be punished. For instance, some salafist imams in Belgium, the Netherlands and Norway refused to shake hands with women, for which they received negative coverage in the press (e.g. `https://www.rt.com/news/402238-norway-debate-muslim-refuses-woman-handshake/`).

[3] We think that our results also shed light on situations where utility is derived from conforming to one's group identity instead of from a material payoff (Akerlof and Kranton 2000; Tajfel and Turner 1986, 1979). A raft of recent empirical evidence has demonstrated that social identity can influence individual decision-making and behavior in a wide range of respects, such as group problem-solving (Chen and Chen 2011), polarization of beliefs (Hart and Nisbet 2011; Luhan et al 2009), preferences over outcomes (Charness et al 2007), trust (Hargreaves Heap and Zizzo 2009), redistribution preferences (Chen and Li 2009), punishment behavior (Abbink et al 2010), discrimination (Fershtman and Gneezy 2001), self-control (Inzlicht and Kang 2010), competitiveness (Gneezy et al 2009) and time horizons for decision-making (Mannix and Loewenstein 1994). Several studies have successfully induced

a relatively small group size and in which the benefits from coordinating are large (with a strong 'social value' component), a setup that we conjecture to be particularly conducive for bad social norms, we vary the information about others' preferences in two ways. First, we compare a version of the game in which subjects are uncertain about others' preferences with a version in which subjects are fully informed. Second, in the version in which they are uncertain about others' preferences, we allow subjects to communicate about their intended actions.

We use the version of the game with incomplete information about others' preferences to investigate some other variables that are key in the approach of Brock and Durlauf (2001). An essential component for the persistence of inefficient social norms is a strong social value component. Group size is another variable that plays a more subtle role according to our model.

The experimental results show that the information about others' preferences is crucial for the emergence and persistence of bad norms. In agreement with pluralistic ignorance, when subjects are fully informed about others' preferences, groups move swiftly away from a good equilibrium after it has become bad. Allowing subjects to communicate also helps to break norms that have become bad. Communication reduces the uncertainty about other subjects' preferences and intended behavior. On the other hand, bad norms thrive when subjects are uncertain about the payoffs of others.

While these results support the pluralistic ignorance perspective, other experimental results accord well with the Brock and Durlauf approach. That is, the stronger the social value component, the more likely a bad norm is to persist. This result resonates with the finding in minimum effort games that it is more difficult to coordinate on the good equilibrium when it is individually more costly to do so (e.g., Devetag and Ortmann 2007). We find that smaller groups are better at breaking bad norms in the short term, but across longer horizons, this effect disappears.

Our paper contributes to a small related literature on the emergence and persistence of bad norms. Devetag and Ortmann (2007) survey how bad outcomes can emerge in team production processes that are characterized by a minimum effort production function. In the minimum effort game, players simultaneously exert costly effort, and the minimum effort in the team determines its productivity. The stage game hosts a multitude of Pareto-ranked equilibria. In agreement with risk dominance, subjects in experiments usually quickly coordinate on a bad equilibrium that offers them a secure but low payoff, unless group size is very small (Van Huyck et al 1990; Knez and Camerer 1994).[4] A special feature of the minimum effort game is that if only one "rotten apple" provides low effort, all other players want to choose the same low effort. In this sense the minimum effort game is not about norms, because it is

group identity directly in the lab to test for different effects; e.g., Chen and Chen (2011), Charness et al (2007), Eckel et al (2007), among others.

[4] It appears to be very hard to avoid bad outcomes in minimum effort games, but there are some reliable factors that help subjects coordinate on better outcomes (Cachon and Camerer 1996; Weber 2006; Chaudhuri et al 2009; Kopanyi-Peuker et al 2015)

not a game where players want to follow what the majority in the group does. In addition, in the game that we study in the experiment the good equilibrium always risk-dominates the bad equilibrium, so risk dominance by itself cannot explain the persistence of bad norms that we observe in some circumstances. In a similar vein, Lim and Neary's (2016) experimental investigation of stochastic adjustment dynamics also uses a large binary-action population game, the language game, in which individuals' choices are strategic complements. They find strong evidence that individuals behave consistently with a best-response learning rule based on the previous period's outcomes, which, in a noisy environment, can lead to groups escaping coordination equilibria. The support for their learning model neatly coincides with the expectations-formation process we describe in Section 2.4. While our results are broadly consistent with this literature, our game also yields different insights: in the game that we study incomplete information on others' preferences is needed for the persistence of bad norms, while in the minimum effort and language games the bad outcome results even with complete information about preferences.

More recently, Abbink et al (2017) identify an alternative driver of bad norms. The central insight from their experiment is that punishment opportunities can, under certain circumstances, lead to socially destructive norms being enforced in public good games. Specifically, in a linear public good game where group members only marginally benefit from others' contributions, such that the socially optimal act is to not contribute, they find that subjects support a bad social norm when they have the possibility to punish free-riders. The key difference between their approach and ours is that they study the emergence of bad social norms in inefficient public good provision, whereas we focus on pure coordination situations in which the question is whether groups can move from one equilibrium to a better one.

Closely related to our paper in terms of experimental design is Andreoni et al (2017). Their investigation of so-called 'conformity traps', conceived independently and concurrently, complements our approach. The most important differences in design are the information environment and the payoffs pertaining to individuals who deviate from a norm. Individuals in their experiment know the true distribution and evolution of group preferences, such that pluralistic ignorance cannot play a role. By comparison, in our setup the individuals who deviate first from the current norm incur disproportionately large costs for pioneering the change, creating stronger incentives to wait for others to deviate first.[5] A particularly relevant feature of their results is that bad norms can still persist with full information over group preferences, so long as the strength of social payoffs is sufficiently high. Other than that, their main results are consistent with our own: (1) The scale of social payoffs, relative to individualistic utility differences, is crucial for conformity to a bad equilibrium, (2) Smaller groups can break a conformity trap faster, and (3) Anonymous communication through polls can aid escaping a conformity trap.

[5] Their design also differs in terms of the matching structure: in each round, matches are pairwise with external payoffs for group conformity, rather than group coordination.

The remainder of the paper is organized as follows. Section 2 presents the game and some theoretical benchmarks. It shows how social value and social interactions shape a unified, tractable theory of bad norms. The model's implications are derived both analytically and through simulation. In Section 3, we detail the design and procedure used to transpose the model into the laboratory. Section 4 discusses the experimental results, from which the conditions under which bad norms can evolve and persist are demonstrated, and Section 5 concludes with a discussion of the results and implications.

## 2 Game and theoretical benchmarks

We adopt Brock and Durlauf's (2001) model of discrete choice with social interactions, with minor modifications, as a vehicle for investigating the persistence of bad norms in an experiment. We augment their game to allow for incomplete information about other players' preferences and to allow preferences to change over time. We propose a simple dynamic belief-updating rule that selects equilibria in the dynamic context. This analysis clarifies the circumstances under which we expect groups to experience a shift in equilibrium when the payoffs of the game evolve. We start with an exposition of the full information stage-game.

### 2.1 The full information stage-game

$N$ players choose between two options. For example, teenagers in a social group decide whether or not to smoke. A player's payoff from the chosen option is composed of her *private value* and her *social value*, which measures the congruence between the player's choice and those of the group. Every player knows that each option's private value is comprised of the sum of a *common value* and a player-specific *private shock*. The (continuous) distributions generating the private shocks for the two choices are known to all the players. In the full information stage-game, players are informed of the common values for each choice, and of their own private shocks for each choice (but not of the private shocks of the others) at the start of the stage-game. In line with the approach of Brock and Durlauf (2001), player $i$ receives a payoff of:

$$V(\omega_i) = u(\omega_i) + S(\omega_i, \omega_{\neg i}) + \epsilon_i(\omega_i), \qquad \omega_i \in \{-1, 1\} \tag{1}$$

Here, $\omega$ represents the choice variable, taking the value of 1 (smoking) or $-1$ (not smoking). $u(\omega_i)$ represents the common value from $i$'s choice $\omega_i$, and $\epsilon_i(\omega_i)$ is a player choice-dependent shock. The shocks $\epsilon_i(\omega_i)$ have a mean 0 and are identically and independently distributed across all players and choices such that the difference $\epsilon_i(-1) - \epsilon_i(1)$ has a known probability distribution function $F(\cdot)$.

$S(\omega_i, \omega_{\neg i})$ gives the social value of the choice that depends on player $i$'s choice $\omega_i$ and the choices of all other players $\omega_{\neg i}$. In this game, the assumption is made that the utility derived from social payoffs exhibits "constant and totalistic strategic complementarity" (Brock and Durlauf 2001, p. 238), which is also employed in Andreoni et al (2017)'s design. This means that players are always happier by the same amount when one more person makes the same choice as them. With this assumption, the form of social value is stipulated in (2):

$$S(\omega_i, \omega_{\neg i}) = J\omega_i m_i \tag{2}$$

where $m_i = \frac{\sum_{j \neq i} \omega_j}{N-1}$ represents the average choice of the other players, and $J(> 0)$ represents the *social factor*, which weighs social utility relative to the direct private-value payoff. To be very clear on terminology: a higher *social factor*, $J$, increases $i$'s (positive) *social value* if her behavior conforms to the majority choice, or decreases her (negative) social value if her behavior is in the minority. Notice that the inclusion of the social value in the payoff ensures that an individual is automatically punished if she deviates from the behavior of others. This accords with the sanctions from deviations of Bicchieri's (2017) definition of social norms.

## 2.2 Equilibria of the full information stage-game

We define an equilibrium $\rho^*$ of the game as *the expected proportion of the group choosing* $\omega_i = -1$, *such that no player would be better off changing her choice in expectation.* It will be useful to write this in terms of the expected average choice of the group, $m^* = \frac{1}{N}\sum_{i=1}^{N} \omega_i \in [-1, 1]$. The equilibrium is therefore specified by:

$$\rho^* = \frac{1 - m^*}{2} \tag{3}$$

Players cannot *ex ante* observe $m_i$ but instead must base their decision on an expectation of average group choice:

$$m_i^e = \frac{\sum_{j \neq i} \mathbb{E}_i(\omega_j)}{N - 1}$$

where $\mathbb{E}_i(\omega_j)$ represents $i$'s expectation over $j$'s choice. In equilibrium, players' expectations are consistent with how others play the game. It is convenient to define $d = u(-1) - u(1)$ as the difference in common values and $d_i = d + \epsilon_i(-1) - \epsilon_i(1)$ as the difference in private values for player $i$. For example, $d_i$ represents $i$'s net private preference for not smoking in the absence of peer effects, while $d$ represents the average private preference for smoking in the group.

We are only interested in situations in which social interactions affect behavior (in expectation), and so we restrict our analysis to the region $-2J \leq d \leq 2J$.

**Proposition 1** *An equilibrium is characterized by the common threshold decision rule "Choose $\omega_i = -1$ if and only if $d_i > c^*$", where the common threshold is $c^* = 2Jm^*$. An equilibrium expected average choice level of the group, $m^*$, solves:*

$$m^* = 2F(2Jm^* - d) - 1 \tag{4}$$

*where $F$ is the CDF of the difference in private shocks.*

We relegate the proof of Proposition 1 to the Appendix.

Equation (4) is the stage-game equilibria condition for the expected average choice level, corresponding to a common threshold $c^*$, for any given distribution of shocks. This is a minor generalization of Brock and Durlauf (2001).[6] The threshold $c^*$ depends both on a player's beliefs about group behavior as well as the (fixed) social value strength. It follows that a player $i$ maximizing her expected utility chooses $\omega_i = -1$ if $d_i > 2Jm_i^e$.

There exists at least one equilibrium and, for strictly unimodal distributions, at most three equilibria satisfying (4).[7] The number of equilibria depends on both the social factor and the difference in common values: multiple equilibria exist only when $J$ is sufficiently large relative to $d$. Notice that bad norms can only arise when multiple equilibria exist. In such cases, and adopting for convenience the notation of (3), two stable equilibria close to the poles $\rho_-^* \approx 0$ and $\rho_+^* \approx 1$ emerge.[8] It is noteworthy that it is not required that all or even any of the players have a private value preference for a particular choice for it to exist as a pure equilibrium.

### 2.3 The incomplete information stage-game

Notably, players in the full information stage-game know both the distribution generating the private shocks for all individuals and the common values for each choice. In practical applications, people may not have such detailed information. Also, notice that the full information game does not give the phenomenon of pluralistic ignorance a good shot: because players know the common values, they can be quite certain about which choice will be preferred

[6] In Brock and Durlauf (2001) the authors assume that shocks follow an extreme value distribution. The convenient properties of this distribution allow for analytical computation of rational expectations equilibria from the symmetry of $N$ expectations equations.

[7] A rigorous proof is somewhat laborious and we refer interested readers to similar techniques discussed in detail in (among others) Brock and Durlauf (2001) and Rothenhäusler et al (2015).

[8] Recall that $\rho^*$ is the expected proportion of the group choosing $\omega_i = -1$. Due to the continuous distribution of the private shocks across all possible values on the real axis, there is always a positive probability of a private difference $|d_{it}| > 2J$, and so the equilibrium proportions are never exactly at the poles 0 and 1. With some abuse of terminology, a 'mixed-proportions' equilibrium $\rho_{\pm}^* \in (\rho_-^*, \rho_+^*)$ also exists. In a setting where the parameter space is such that three equilibria exist, the equilibria at the poles are stable whereas the mixed-proportioned equilibrium is unstable. Small perturbations in players' expectations will move players away from this equilibrium.

by the majority. Pluralistic ignorance receives a fairer shot in the incomplete information stage-game. In this game, players do not separately observe the common values or their individual shocks, but rather the combined private value $v_i(\omega_i) = u(\omega_i) + \epsilon_i(\omega_i)$. We think that the analysis of the full information stage-game also pertains to the incomplete information game if players have come to know the common values from historical information or experience.

The analysis of the stage game indicates that both 'good' and 'bad' norms can exist as equilibria so long as the scale of social payoffs is sufficiently large with respect to the direct incentives. It does not provide any guidance on predicting which equilibrium will be selected. For the game that we study in this paper, risk dominance selects the 'good' equilibrium. The opportunity cost for player $i$ deviating from the good equilibrium is $2J + d_i$, while the opportunity cost for player $i$ deviating from the bad equilibrium is $2J - d_i$, and therefore the good equilibrium risk-dominates the bad equilibrium.[9] Thus, risk dominance is not helpful to support our intuition that in certain circumstances groups may shift from a bad to a good equilibrium while in other conditions the bad equilibrium will persist. Our interest in bad social norms is precisely this. To shed light on this, we turn to a dynamic analysis that can be tested in the lab.

### 2.4 Dynamic Analysis

Here, we consider the possibility that the $N$ players repeatedly play the full information stage-game or the incomplete information stage-game. In either case, it is known that new private shocks are independently drawn every round, and that the (possibly unobserved) common values can change across rounds. Therefore, it may be that the initially 'good' option (i.e. the option possessing the higher common value) loses its attractiveness and becomes the 'bad' option after some time. For example, new information about health consequences causes most of the teenagers to privately prefer not to smoke.

We now describe a dynamic process that predicts the likelihood of the emergence of each of the two stable equilibria under different conditions. This process is then simulated for the parameter space of $d$ and $J$ in order to motivate the choice of parameters for the laboratory experiment. We relegate most of the analysis and simulations to the online appendix and provide a brief summary below.

In the dynamic environment, we introduce a simple function for an individual's belief formation $m^e_{it}$ in round $t$ which allows players to form beliefs when the environment changes and play is not (yet) in equilibrium. We assume that this function depends on two pieces of information available to individuals:

[9] This result depends on the linear payoff function used in our and Brock and Durlauf's (2001) model. To derive the condition for risk dominance in our game, we used the procedure described in Section 3.1 of Keser et al (2012), who apply Harsanyi and Selten's (1988) tracing procedure to a technology-adoption game.

the difference in their private values, and the common historical ‘norm’, here represented by the previous round’s group choice.[10] $m_{it}^e$ is logically assumed to be decreasing in $d_{it}$ and increasing in $m_{t-1}$. We further assume that $m_{it}^e$ is bounded from below at $\psi = -1$ for $d_{it} \geq 2J$ and bounded from above at $\psi = 1$ for $d_{it} \leq -2J$. That is, we focus on regions in which social interactions matter.

A parsimonious expectations function satisfying these criteria is:

$$m_{it}^e = \frac{1}{2}\left(m_{t-1} - \frac{d_{it}}{2J}\right) \tag{5}$$

whereby players place equal weight on the current round’s private values and the previous round’s group choice in forming their expectations.[11] Note that if the weight on $\frac{d_{it}}{2J}$ had been 0 instead of $\frac{1}{2}$, the belief updating process would have resembled the belief-learning and fictitious play models of Cheung and Friedman (1997) and Hopkins et al (2005) (among others). According to a pure belief-learning model, players would not respond to changes in their private values because their expectations are only backward looking. Given that in our game players know that the environment may change, it is plausibly more likely that they pay attention to both past behavior of other players and changes in the environment, as illustrated in (5).

We use (5) to impel the simulations that guide the parameter choices for the experiment. We also vary the weighting in the simulations; these details can be found in the online appendix. Consider a period of rounds in which the difference in the common values, $d_t$, is constant. The expectations-formation process of (5) enables a researcher who knows the common values and the distribution of the private shocks (though not their realizations) to predict both the average group choice $m_t$ in a given round and the dynamically-stable equilibria over the period.

We say that a bad norm persists when $\rho^* \approx 0$ is a possible equilibrium during a sufficiently long period of time in which choice $\omega_i = -1$ is preferable from a group welfare perspective. As long as the difference in common payoffs, $d$, is large enough relative to the social factor, $J$, the only sustainable long-run equilibrium in the system is the ‘good’ norm $\rho^* \approx 1$. However, when $d$ is small relative to $J$ so that social value is relatively more important than individualistic returns, two stable equilibria emerge: $p^* \approx 0$ and $p^* \approx 1$. Again, the model makes clear predictions with regard to the social factor: The stronger this factor, the more likely a bad norm is to persist.

Computer simulations of groups of rational players who form expectations according to (5) shed light on bad norm persistence in our dynamic setting.[12]

[10] Past history has been shown to play a role in equilibrium selection in similar coordination games in the lab, which motivates and supports this dependence (Romero 2015; see also Cason et al 2012, Huck et al 2011, Cooper and Kagel 2003).

[11] We also considered a more general function with a free weighting parameter $\delta$. We estimated how $\delta$ changes with the treatments, and these results can be found in the online appendix.

[12] See the online appendix for details.

They predict that if shocks follow a standard normal distribution and $d \approx 2$ for a long period of time, a social factor of $J = 4$ enables a group to break the bad norm. For a stronger social factor of $J = 8$, the bad norm persists. As opposed to the static analysis, there are also interesting predictions with respect to group size. Smaller groups are slightly more likely to break a bad norm, and to do so faster, which is consistent with the theoretical predictions of the dynamic analysis (see Appendix).

The most important feature of (5) is that it does not depend on whether players are informed only of the sum of the common value and their private shock, as in the incomplete information game, or of the two components separately, as in the full information game. This suggests that the information provided to the players is an interesting treatment variable. As in Brock and Durlauf (2001), our theoretical extension does not differentiate between whether players are partially or fully informed. On the other hand, the psychology literature around pluralistic ignorance argues that partial ignorance of this distribution is a necessary condition for the phenomenon to occur (Prentice 2007; Bicchieri 2005; Sherif 1936).

Another interesting possibility is that full information is endogenously generated through communication. Communication may play a dual role in our game. It may not only help players share information about which choice they prefer but it may also help players to coordinate expectations on the same equilibrium. From this perspective, communication may have an even more positive effect than full information.[13] In our experiment, we are particularly interested in anonymous signalling that one might expect from posting on internet bulletin boards or social media. While this cheap talk is non-binding, it could be thought of as shifting the focus away from historical precedent and towards illuminating present group preferences.

The theory provides a testable framework for the role of the social value in perpetuating bad norms. Its predictions demonstrate that the precise conditions under which a bad norm can persist, or pluralistic ignorance can emerge, are not trivial. A laboratory experiment is an appropriate medium through which to test these predictions.

## 3 Experimental design

The computerized experiment was run at the CREED laboratory of the University of Amsterdam. Subjects read the instructions at their own pace and

[13] Andreoni et al (2017) find a positive effect of communication on equilibrium selection in a similar environment. Choi and Lee (2014) find that coordination is enhanced by allowing communication in networks. However, in their experiment the roles of implicit agreement and punishment from deviations are necessary for improving coordination. Ochs (2008) shows that the effect of communication can differ in different coordination games; interestingly, this paper also highlights the role of past precedent, a mechanism that in our experiment corresponds to the strength of the bad norm.

then had to successfully answer some control questions before they could proceed.[14] In the experiment, subjects earned points that were converted at the end of each session at an exchange rate of five points for one euro cent (500 points = 1 euro). At the start of the experiment, each subject was randomly assigned to a group and participated in 50 rounds of the game. Subjects were not told how many rounds the game would last. Points were summed over the 50 rounds and the final game earnings were paid privately. In addition, subjects received a show-up fee of 3 euros.

Recruitment was conducted at the University of Amsterdam. Each subject participated in only one session of the experiment. Each session took approximately one hour. Multiple groups were run in each session, but the composition of the groups themselves remained constant. In total, 346 subjects participated in 19 sessions, and earned on average 14.30 euros (s.d. 2.00), including the show-up fee.

We start with a description of the incomplete information treatments. The game used in the experiment featured 50 rounds of the stage game of the model described in the previous section, but presented in a more subject-friendly manner. In each round players made an individual choice between two ‘doors’, $A$ and $B$, from which they could earn points. An individual’s payoff depended both on her *private value* and her *social value*. Each door’s private value, which an individual observed before making the choice, consisted of the sum of that door’s common value and an individual shock. Group members could not observe the components of their private values, but they knew both that the common values were the same for all group members in a given round, and that all shocks were randomly drawn from a standard normal distribution.

Social value was determined by the proportion of other group members who made the same choice as an individual, scaled by a social factor; if an individual was in the minority, the social value was negative. Specifically, the social value to a participant was formulated in terms of the number of points she would gain (lose) for each group member who made the same (different) choice as her in a given round.

After the choices by all subjects were submitted in a given round, the payoffs were presented along with information about the number of other group members who chose each door. The experiment then continued to the next round, and subjects saw their new private values for the doors.

The common door values used in the experiments were randomly generated in order to create appropriate conditions for testing bad norms and to coincide with the theoretical analysis and simulations. Figure 1 shows how the common door values developed over time in each group of each treatment. Specifically, unknown to the subjects,

– Door A was initially preferred by a large margin (roughly 6 points)

[14] The Appendix lists the instructions for the incomplete information treatment with $N = 6, J = 4$ (“*SmallWeak*”), as well as for the Communication and Full Information treatments. Instructions for the other treatments differed from *SmallWeak* only with respect to the parameter values.

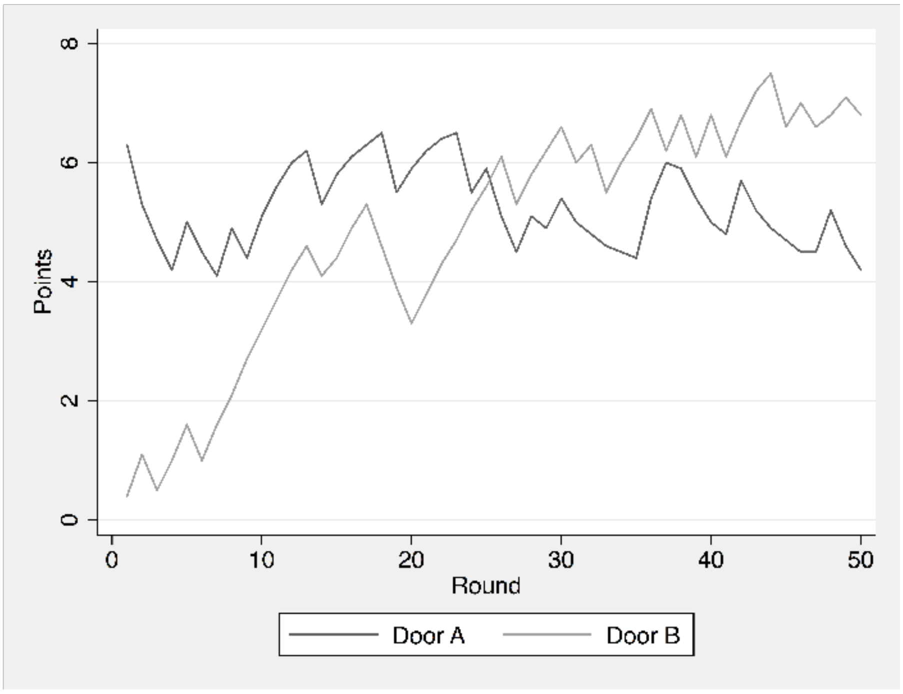


**Fig. 1** Common door values
*Notes:* For participants in the laboratory experiment, all values were multiplied by 10.

– Common values of each door could change by a maximum of 1 point in each new round
– Door A remained preferable until round 25, after which Door B overtook Door A
– From round 40 until the end of the session, Door B held a positive difference over Door A of approximately 2 points.

These stipulations were designed to create an environment in which in the first half of the session, a social norm of choosing Door A could emerge, which would then consistently be the socially inefficient choice in the second half.

To make things easier for subjects to understand, the linear nature of the social value was explained in terms of the number of points earned per other player making the same choice. The actual presentation of the instructions multiplied all common and private values from the theoretical model by 10 so that subjects did not have to calculate decimals. We continue to use the unmultiplied values in the rest of the paper for consistency. For example, in the treatment with $N = 6$ and $J = 4$ ("*SmallWeak*"), the instructions contained the sentence:

> *You* ***gain 8 points*** *for every person who makes the* ***same*** *choice as you, but you* ***lose 8 points*** *for every person who makes the* ***opposite*** *choice to you.*

Notice that in the experiment, like in the theoretical model, an individual $i$ thus receives a payoff according to (1) in round $t$, where $\omega_{it} = 1$ is defined as choosing Door A, $\omega_{it} = -1$ as choosing Door B, $m_{it}$ is the average choice of the others in the group, and $J$ is the social factor.

All treatments made use of the experimental variant of the game described above. In the *Full Information* treatment we replicated the parameters of the *SmallStrong* treatment ($N = 6, J = 8$), but gave subjects full information about the true distribution of others’ private preferences. Specifically, subjects could precisely see the decomposition of their private values into the common values and their own personal shocks for each door in every round. Subjects were not informed of the specific shocks for the other group members, but knew the distribution generating the draws. The dynamic model of the previous section does not differentiate between the setups of *FullInformation* and *SmallStrong* in its predictions. The bad norm is expected to persist in either treatment. The psychological literature on pluralistic ignorance, however, argues that uncertainty over the true distribution of private preferences is an important condition for this phenomenon to exist (Prentice 2007).

The *Communication* treatment replicated the information structure and parameters of the *SmallStrong* treatment, but allowed subjects to communicate. In every round before they chose their door, each subject could express her intention on a ‘Bulletin Board’. Posts on the Bulletin Board were anonymous. Subjects were informed that there was no obligation to honor a post, and that it was also possible not to post anything. After everyone had made their decisions about posting for that round, group-members saw the total number of posts (or ‘intentions to choose’) for Door A and Door B before they actually made their final choice of door. We expected the *Communication* treatment to be at least as successful as the *Full Information* treatment in breaking bad norms, because it allowed subjects to coordinate their expectations of which choice would attract the majority in the group.

Table 1 summarizes the main features of the treatments.[15] These were varied between subjects, with the three additional treatments based on combinations of the two parameters of interest: the social factor and the group size.

Private shocks were randomly drawn from $\sim \mathcal{N}(0, 1)$ for each individual, door and round. Realizations of private shock distributions for each individual were matched for treatments with the same group size. That is, each of the 8 groups in *SmallWeak* had a matched group in *SmallStrong* with the same private shocks distributed across group members, doors and rounds, and likewise for the 7 groups in each of the larger treatments. In each round of each treatment, subjects’ screens displayed the round number, the cumulative earnings, the private values for each door, a choice button for Door A or Door

[15] The group sizes ($N = 6, 11$) were chosen to make it easier for subjects to calculate the potential social values, which required considering fractions of 5 or 10. The social factors ($J = 4, 8$) were chosen so as to predict opposite equilibria in computer simulations whereby individuals are assumed to assign equal weights to both the existing norm and their own private information in forming their expectations. See the online appendix for further details.

**Table 1** Treatments

| Treatment | Social factor $J$ | Group size $N$ | #Groups | Bulletin board? | Common info? |
|---|---|---|---|---|---|
| *SmallWeak* | 4 | 6 | 8 | No | No |
| *SmallStrong* | 8 | 6 | 8 | No | No |
| *BigWeak* | 4 | 11 | 7 | No | No |
| *BigStrong* | 8 | 11 | 7 | No | No |
| *Communication* | 8 | 6 | 8 | Yes | No |
| *Full Information* | 8 | 6 | 8 | No | Yes |

B to be submitted, and a history footer. The history footer contained the total history of the proportion of other group members making each choice for every completed round.[16] At the end of round 50, subjects filled out a short questionnaire before they were paid. Below we summarize the main hypotheses that our treatments allow us to test.

**Hypothesis 1** *Bad norms are more easily broken when subjects receive complete information about the common values and their own private shocks.*

**Hypothesis 2** *Bad norms are more easily broken when there is a possibility to anonymously communicate intended choices.*

**Hypothesis 3** *With incomplete information, groups are more likely to stay with choosing Door A after it has become the bad norm when* $J = 8$ *than when* $J = 4$.

**Hypothesis 4** *With incomplete information, groups are equally likely to stay with choosing Door A after it has become the bad norm when* $N = 6$ *or* 11.

## 4 Results

We present the results in two parts. Section 4.1 investigates the role that information and pluralistic ignorance play for the persistence of bad norms. Section 4.2 provides the results of the additional treatments. It clarifies what plays a role in the development of bad norms when there is incomplete information.

### 4.1 Pluralistic ignorance: the role of full information in breaking bad norms

A comparison of the *SmallStrong* treatment, the *Full Information* treatment and the *Communication* treatment allows us to shed light on pluralistic ignorance. Figure 2 shows when groups on average switch to the good norm in

[16] An example screenshot is displayed in the Appendix.

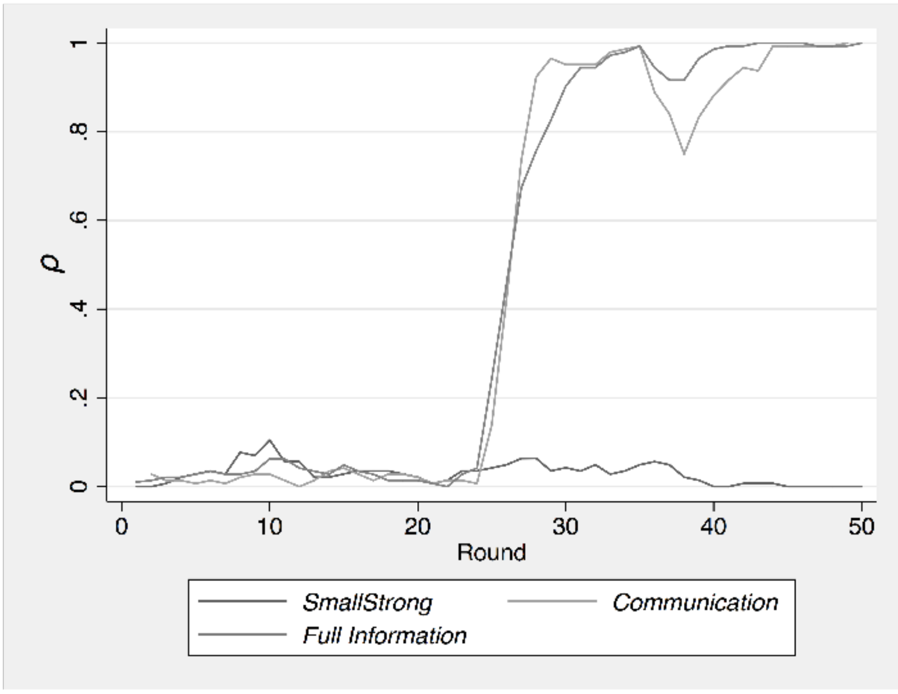


**Fig. 2** Average round-by-round group choice for $N = 6, J = 8$, including anonymous communication and decomposed private values (full information) treatments
*Notes:* Each treatment line depicts the average group proportion choosing Door B across all groups in the treatment. After round 25, coordination on Door A represents a bad social norm. Lines have been smoothed via a three-round equally weighted moving average.

these treatments (if they do). Notably, the bad norm was not broken in any of the groups in the *SmallStrong* treatment, in which the strong social factor provides favorable conditions for the persistence of bad norms. Providing full information on the decomposition of common values and private shocks in the game with the same parameters dramatically changes the picture. All groups broke the bad norm in both the *Full Information* and *Communication* treatments, a significant improvement over groups in *SmallStrong* ($p = .00$ for both pairwise rank-sum tests; see Table 2). In the *Full Information* treatment, most groups switched to the good norm in round 26, immediately after the common values shifted towards Door B, and all groups switched to the good norm by round 28. Remarkably, all groups also broke the bad norm almost immediately in the *Communication* treatment, despite the shift of the common values being unobserved. These results accord with psychological theories of social norms that propose that payoff uncertainty of other group members is a crucial ingredient for bad norm persistence.

While we did not explicitly measure expectations, we can identify extreme circumstances where we might observe behavior consistent with pluralistic ignorance. Specifically, if all individuals in a group have a private value of Door

**Table 2** Key performance indicators by treatment

| | Treatments | $\rho_{50}$ | $\bar{\rho}_{(45-50)}$ | $\bar{\rho}_{(t\geq 26)}$ | $\bar{\rho}_{all}$ | $\bar{t}_{switch}$ |
|---|---|---|---|---|---|---|
| | *Full Information* | 1.00 | 1.00 | .93 | .48 | 26 |
| | *Communication* | 1.00 | 1.00 | .92 | .47 | 27 |
| | *SmallStrong* | .00 | .00 | .03 | .03 | - |
| | *SmallWeak* | .65 | .62 | .46 | .26 | 30 |
| | *BigStrong* | .03 | .02 | .02 | .02 | - |
| | *BigWeak* | .47 | .36 | .26 | .14 | 39 |
| Testing information uncertainty: | *FI vs SS* | .00*** | .00*** | .00*** | .00*** | - |
| Testing communication: | *C vs SS* | .00*** | .00*** | .00*** | .00*** | - |
| Testing social factor: | *SW vs SS* | .00*** | .00*** | .01*** | .01*** | - |
| | *BW vs BS* | .02** | .04** | .11 | .06* | - |
| Testing group size: | *SW vs BW* | .46 | .41 | .30 | .30 | .17 |
| | *SS vs BS* | .12 | .02** | .82 | .56 | - |

*Notes:* In the upper panel, values are averages of the group values within each treatment. $\rho_{50}$ is the final group proportion choosing Door B. $\bar{\rho}_{(45-50)}$ is the average $\rho$ across the last six rounds. $\bar{\rho}_{all}$ is the average $\rho$ across all rounds. $\bar{\rho}_{(t\geq 26)}$ is the average $\rho$ from round 26, when the common value of Door B becomes larger than that of Door A. $\bar{t}_{switch}$ is the average switching time, considering only those groups that switched to Door B by round 50. In the lower panels, $p$-values are derived from Mann-Whitney rank sum tests. In the tests, each group yields one observation. Full indicators by group are found in the Appendix.

B exceeding that of Door A in a particular round of the experiment, but *all* group members choose Door A ($\rho = 0$), the group is said to exhibit *total pluralistic ignorance*. Such incidence represents the worst-case scenario from a social welfare perspective; in fact, if social value is ignored, any other combination of choices would be a Pareto improvement. In the experiment the number of rounds in which total pluralistic ignorance could potentially exist is naturally higher for smaller groups, as groups with more individuals are more likely to produce at least one group member realizing extreme private shocks. Figure 3 compares the number of potential rounds of total pluralistic ignorance to those that eventuated in the experiment. This reveals a strong social factor effect. *SmallStrong* and *BigStrong* saw total pluralistic ignorance in, respectively, an average of 87% and 81% of each treatment's potential rounds, while for *SmallWeak* and *BigWeak* the average frequencies were 27% and 31%. On the other hand, in both the *Communication* and *FullInformation* treatments, no group ever exhibited total pluralistic ignorance for any round, a significant difference to the behavior in the comparison treatment *SmallStrong* ($p = .00$ for both pairwise rank-sum tests).

In the *Communication* treatment, only two of the 48 participants chose not to use the Bulletin Board at all; of the rest, most subjects took the opportunity to post in every round. Moreover, the collection of posts on the Bulletin Board

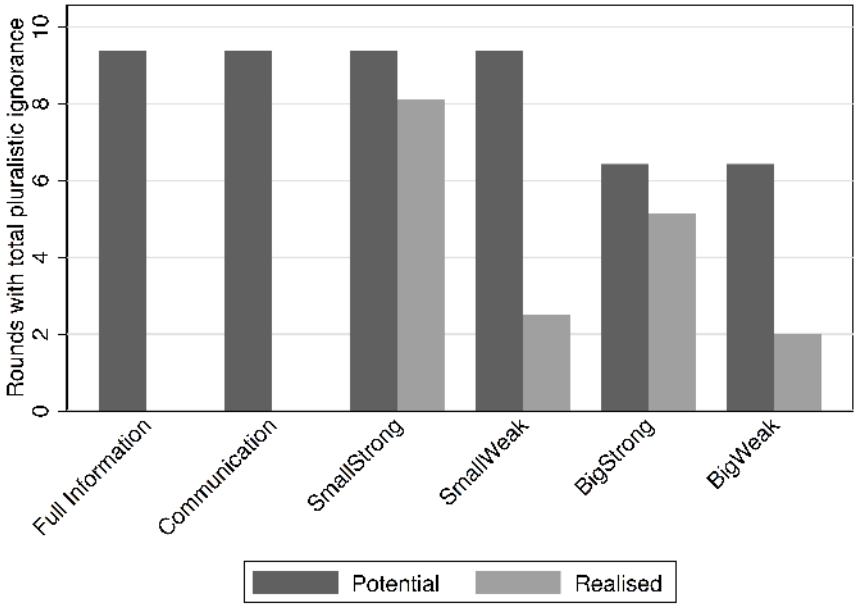


**Fig. 3** Mean potential and realized rounds of total pluralistic ignorance.
*Notes:* A ‘total pluralistic ignorance’ round is defined as a round $t$ in which all players receive $d_{it} > 0$ and subsequently choose Door A ($\rho_t = 0$). Amounts are averages per group out of a total of 50 rounds.

was overwhelmingly indicated as the primary means of expectation formation in the answers to the questionnaire. Figure 4 presents the average number of announcements to opt for Door B together with the actual choices for Door B as the rounds unfolded. For all eight groups, the switch in average group indications from Door A to Door B coincided with the shift in the difference in common values. Interestingly, all participants exploited the anonymity by acting contrary to their posted indication in at least one round (mean = 5.3 rounds, s.d. = 2.4).

The above analysis supports the first two key results regarding the role of full information on preferences and communication:

**RESULT 1:** *In agreement with pluralistic ignorance, bad norms persist when subjects are uncertain about others’ preferences but not when subjects are fully informed.*

**RESULT 2:** *Communication always breaks the bad norm.*

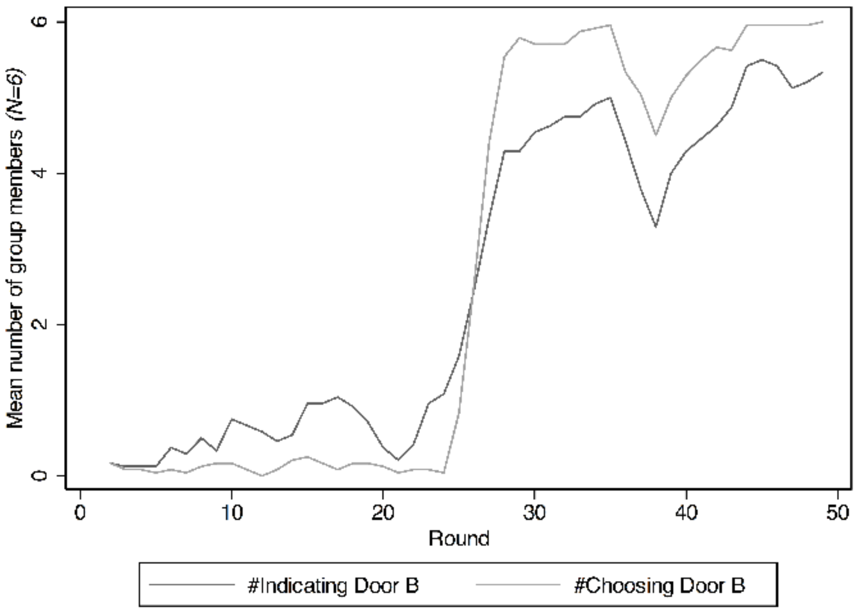


**Fig. 4** Indications and actual choices in the *Communication* treatment, by group
*Notes:* Average round-by-round group indications for "Door B" versus actual choices in the *Communication* treatment. Treatment parameters were: $N = 6$, $J = 8$. Almost all subjects in a group posted their intentions in every round (mean = 5.6 group members, s.d. = 0.6). Lines have been smoothed via a three-round equally weighted moving average.

## 4.2 The roles of the social factor and group size when there is incomplete information

Figure 5 displays the frequency of norm breaking in the treatments with incomplete information. None of the groups with the strong social factor ($J = 8$) switched to Door B by round 50, regardless of group size. When the social factor was weakened to $J = 4$, five out of the eight groups (62.5%) in *SmallWeak* switched to Door B, while three out of seven (42.9%) did the same in the *BigWeak* treatment. The simulations of the theoretical model for the common values, shocks and treatments used in the experiment also predicted a slight favoritism for *SmallWeak* compared to *BigWeak* for the sequence of common values used.

Table 2 demonstrates that the descriptive statistics of the data partitioned by treatment are similar when norm breaking is defined by different measures, such as the average $\rho$ across all rounds, the final rounds, or rounds 26-50 (the rounds after which the common value of Door B overtakes that of Door A). Detailed proportions for the 46 individual groups can be found in the Appendix. For each individual group, the average group choice stuck closely to the two theoretical stage-game equilibria of $\rho = 0$ and 1 across the rounds;

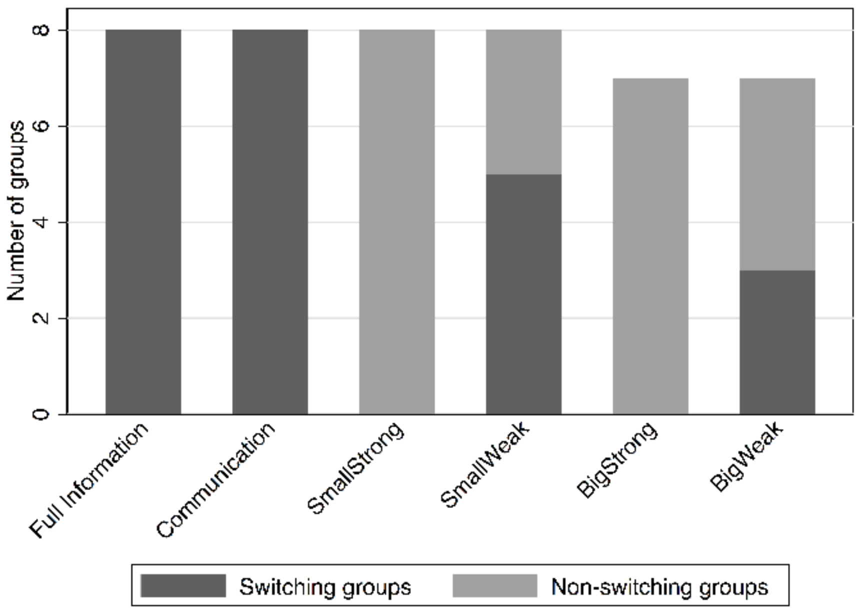


**Fig. 5** Switching groups by treatment
*Notes:* ‘Switching’ is defined as more than half of the group choosing Door B in round 50 ($\rho_{50} > 0.5$).

groups spent few rounds in the socially destructive mixed proportions around $\rho = 0.5$. For the groups that finally broke the norm, once approximately a third of the group had simultaneously chosen Door B the group generally took little time in reaching the more favorable equilibrium.

The third key result reflects our hypothesis regarding the strength of the social factor. The upper panel of Table 2 clarifies that the social factor has a substantial impact on the proportion switching to the good door in the latter part of the experiment. When $J$ is strong, all groups stay with Door A after it has become the bad choice. The lower panels of Table 2 show the extent to which the results differ systematically across treatments. An increase in the social factor significantly enhances various measures of $\rho$ for both $N = 6$ and $N = 11$.

**RESULT 3:** *With uncertainty, bad norms are more likely to persist when the group’s social factor is strong.*

The result is further illustrated in Figure 6. Only groups with the weaker social factor switched their overall door preference after round 25. The figure also reveals that groups of size $N = 6$ that switched to Door B generally did so earlier than the switching groups of size $N = 11$, although these short-run size effects disappeared by the end of the 50 rounds.

The final key result concerns the role of group size. This has a much smaller effect on the persistence of the bad norms. The tests on group size reported

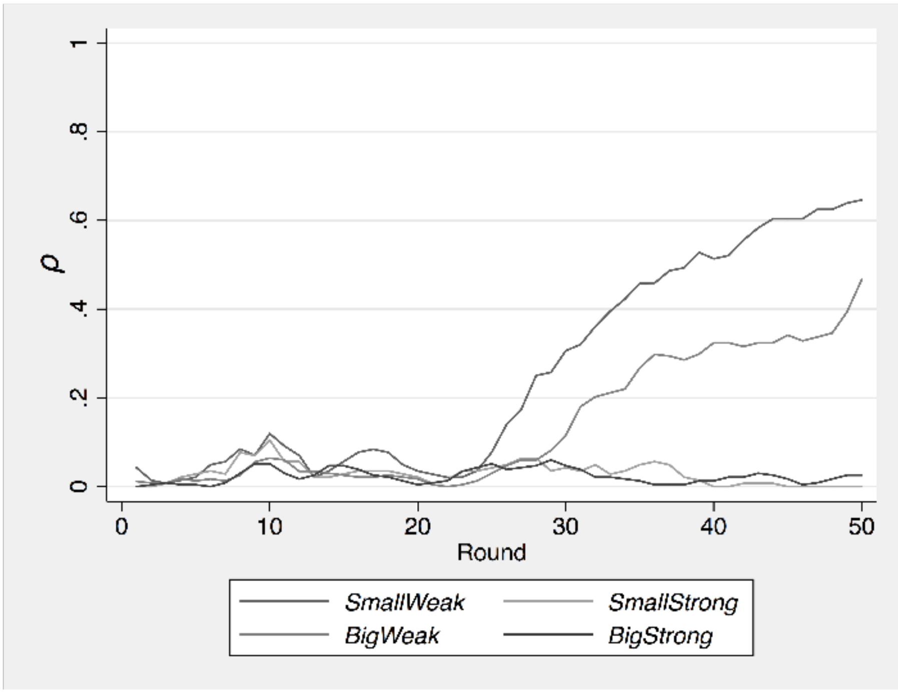


**Fig. 6** Effect of the social factor and group size on group choice
*Notes:* The figure shows the average round-by-round group choice for treatments with information uncertainty and no communication. This highlights the effect of the social factor $J$ and group size $N$ on group choices. Each treatment line depicts the average group proportion choosing Door B across all groups in the treatment. Lines have been smoothed via a three-round equally weighted moving average.

in the lower panel of Table 2 tend to be insignificant. When only the weaker social factor groups are considered, the graphical representation of round-by-round pooled data presented in Figure 6, when broken by group size, does suggest faster deviations from the norm for $N = 6$. However, it is conceivable that the two lines would have converged if the experiment had been extended beyond 50 rounds, so it is impossible to claim a long term group size effect on the eventual persistence or collapse of bad norms.

**RESULT 4:** *With uncertainty, the persistence of bad norms does not depend on group size in the long run.*

Nevertheless, there is some evidence that individuals are less willing to go against the norm when within larger groups in the short term. In the first 20 rounds, for example, although the common value of Door A was always preferred, some individuals received private shocks such that there was an individual incentive to deviate from the norm. Subjects were significantly more likely to deviate when group size was smaller, as evidenced from rank-sum tests of the averaged $\rho$ of rounds 1-20, by group size (*J=4:* Mann-Whitney $p = 0.03$; *J=8:* Mann-Whitney $p = 0.02$).

**Table 3** Deviation statistics during bad norm persistence by treatment

| | *SmallWeak* | *SmallStrong* | *BigWeak* | *BigStrong* |
|---|---|---|---|---|
| Frequency of deviation rounds | 27.5% | 15.8% | 34.7% | 21.7% |
| Average $\rho$ in deviation rounds | 0.191 | 0.183 | 0.143 | 0.109 |

*Notes:* Values are averages of the group values within each treatment, restricted to rounds of bad norm persistence ($\rho < 0.5$). Frequency of deviation rounds is calculated by dividing the number of rounds with deviations by the total number of rounds with $\rho < 0.5$.

This generates support for the mechanism predicted by the model to cause some short-run size effects. Holding social factor strength and other parameters constant, the model predicts that, while the bad norm persists, larger groups will more frequently experience rounds with at least one person deviating, but that these rounds will on average have a lower $\rho$. Table 3 shows that when we control for $J$, the experimental results confirm these predictions.

Interestingly, for $\bar{\rho}_{(1-20)}$ the measure generating tangible short-run size effects, social factor strength, was not found to be significant. This suggests that in these early rounds when Door A is still commonly preferable, it is the size of the group, rather than the social factor, that determines subjects’ predilection to deviate for individual reasons. However, the severity of the loss that usually follows for a subject who decides to deviate depends on the social factor (manifested in the social value). This severity then determines the likelihood that the individual returns to the group choice or continues to deviate in the subsequent round. To sum up, the evidence suggests that social factor strength is chiefly responsible for whether a bad norm persists, while group size plays a role in the short term and in determining the speed of a norm shift.[17]

## 5 Discussion

When there is uncertainty about the preferences of others, bad norms can persist in the laboratory. Bad norms emerge in our experiment as a result of

[17] Groups that do not stay with the bad norm appear to benefit from the presence of ‘Leaders’. Leaders are defined as individuals who choose Door B in two consecutive rounds $t, t+1$ when $\rho_{t-1}, \rho_t < 0.5$. They may be thought of as sacrificing personal gain in order to signal the group and put pressure on the norm, and their presence is highly correlated with breaking down the norm. None of the ten groups in which no Leader emerged managed to switch to Door B. Whether the presence of Leaders is in itself conducive to collapsing a bad norm is an open question, as clear endogeneity issues are present. However, controlling for the social factor, there is a strong positive correlation between the proportion of Leaders in a group and the collapse of the bad norm. The difference in the percentage of Leaders for groups that persist with choosing Door A or eventually switch to Door B is highly significant (Mann-Whitney p=.01). See also Andreoni et al (2017), in which exogenously rewarding deviations from a bad equilibrium in the lab has a positive effect on breaking so-called conformity traps.

a good equilibrium gradually becoming a bad equilibrium in a coordination structure due to changing payoffs over time. Once established, these bad norms can persist so long as the personal incentives to deviate are small and the social factor is strong.

The most important insight from our experiment is that a strong interdependence of payoffs is a necessary but not sufficient condition for the persistence of bad norms. That is, when a strong social factor is paired with full information about the preferences of others, bad norms disappear. This is consistent with insights from psychology, specifically that uncertainty about the true distribution of the private preferences of group members is a necessary condition for pluralistic ignorance to persist. A similarly positive effect results from costless communication. The latter is particularly relevant to several applications of bad norms where tools such as social media can play a role. We reason from our empirical findings that an important condition for bad norm persistence is uncertainty about others' private preferences.

The effect of uncertainty about preferences on the persistence of bad norms was not predicted by our straightforward extension of the Brock and Durlauf (2001) model. Still, our extension serves its purpose to organize the data of the incomplete information treatments. In agreement with the model, smaller groups have a better chance of collectively breaking a bad norm in the short term, but over a longer horizon the prospects between differently sized groups even out. More importantly, the model also accommodates the significant role that the social factor plays: the stronger the incentive to conform to the majority, the harder it is to break a bad social norm. We therefore see a use for the model in explaining bad social norms, and suggest that future theoretical work aims to incorporate the implications of pluralistic ignorance. One approach is to allow the belief formation function to depend on the uncertainty of information. When there is full information, players should place less weight on the previous norm and more on the current preferences of others when forming their expectations about future group behavior. Correspondingly, bad norm persistence should require uncertainty about others' preferences, in agreement with pluralistic ignorance.

Our paper suggests other interesting avenues for future research. Our experimental design automatically monetizes all payoffs that derive from the behavior of the self and others. Further research into applications that feature internalized social payoffs could consider directly triggering group identity in the laboratory, along the lines of Chen and Chen (2011), Charness et al (2007) etc. What a more natural setting of this nature loses in robustness would be compensated by adding support to the behavioral foundations of the modeling of bad social norms proposed in this paper. Our results also motivate a need for further tests in the field, and suggest that bad norm interventions that target uncertainty are worthy of consideration.

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## References

Abbink K, Brandts J, Herrmann B, Orzen H (2010) Intergroup conflict and intra-group punishment in an experimental contest game. American Economic Review 100(1):420–47, DOI 10.1257/aer.100.1.420

Abbink K, Gangadharan L, Handfield T, Thrasher J (2017) Peer punishment promotes enforcement of bad social norms. Nature communications 8(1):609, DOI 10.1038/s41467-017-00731-0

Acemoglu D, Jackson MO (2015) History, Expectations, and Leadership in the Evolution of Social Norms. Review of Economic Studies 82(2):423–456

Akerlof GA, Kranton RE (2000) Economics and identity. The Quarterly Journal of Economics 115(3):715–753, DOI 10.1162/003355300554881

Andreoni J, Nikiforakis N, Siegenthaler S (2017) Social change and the conformity trap. Working paper

Arrow K (1970) Political and economic evaluation of social effects and externalities. In: The Analysis of Public Output, NBER Chapters, National Bureau of Economic Research, Inc, pp 1–30

Bicchieri C (2005) The Grammar of Society: The Nature and Dynamics of Social Norms. Cambridge University Press

Bicchieri C (2017) Norms in the Wild: How to Diagnose, Measure, and Change Social Norms. Oxford University Press USA

Brock WA, Durlauf SN (2001) Discrete choice with social interactions. The Review of Economic Studies 68(2):pp. 235–260

Cachon GP, Camerer CF (1996) Loss-avoidance and forward induction in experimental coordination games. The Quarterly Journal of Economics 111(1):165–94

Cason TN, Savikhin AC, Sheremeta RM (2012) Behavioral spillovers in coordination games. European Economic Review 56(2):233–245

Charness G, Rigotti L, Rustichini A (2007) Individual behavior and group membership. American Economic Review 97(4):1340–1352, DOI 10.1257/aer.97.4.1340

Chaudhuri A, Schotter A, Sopher B (2009) Talking ourselves to efficiency: Coordination in inter-generational minimum effort games with private, almost common and common knowledge of advice. Economic Journal 119(534):91–122

Chen R, Chen Y (2011) The potential of social identity for equilibrium selection. The American Economic Review 101(6):2562–2589

Chen Y, Li SX (2009) Group identity and social preferences. The American Economic Review 99(1):431–457

Cheung YW, Friedman D (1997) Individual Learning in Normal Form Games: Some Laboratory Results. Games and Economic Behavior 19(1):46–76

Choi S, Lee J (2014) Communication, coordination and networks. Journal of the European Economic Association 12(1):223–247, DOI 10.1111/jeea.12058

Cooper DJ, Kagel JH (2003) Lessons learned: Generalizing learning across games. The American Economic Review 93(2):202–207

D’Cruz A (2005) The handshake. Assyria Times Accessed 20 June 2013

Devetag G, Ortmann A (2007) When and why? a critical survey on coordination failure in the laboratory. Experimental Economics 10(3):331–344, DOI 10.1007/s10683-007-9178-9

Eckel C, Grossman PJ, Milano A (2007) Is more information always better? an experimental study of charitable giving and hurricane katrina. Southern Economic Journal 74(2):388–411

Fershtman C, Gneezy U (2001) Discrimination in a segmented society: An experimental approach. The Quarterly Journal of Economics 116(1):351–377, DOI 10.1162/003355301556338

Gage AJ (1998) Sexual activity and contraceptive use: The components of the decisionmaking process. Studies in Family Planning 29(2):pp. 154–166

Gneezy U, Leonard K, List J (2009) Gender differences in competition: Evidence from a matrilineal and a patriarchal society. Econometrica 77(5):1637–1664

Hargreaves Heap S, Zizzo D (2009) The value of groups. American Economic Review 99(1):295–323

Harsanyi J, Selten R (1988) A General Theory of Equilibrium Selection in Games, vol 1, 1st edn. The MIT Press

Hart PS, Nisbet EC (2011) Boomerang effects in science communication: How motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. Communication Research DOI 10.1177/0093650211416646

Hechter M, Opp K (2001) Social Norms. Russell Sage Foundation

Hopkins E, Hofbauer J, Benaim M (2005) Learning in Games with Unstable Equilibria. ESE Discussion Papers 135, Edinburgh School of Economics, University of Edinburgh

Huck S, Jehiel P, Rutter T (2011) Feedback spillover and analogy-based expectations: A multi-game experiment. Games and Economic Behavior 71(2):351–365

Inzlicht M, Kang SK (2010) Stereotype threat spillover: how coping with threats to social identity affects aggression, eating, decision making, and attention. Journal of personality and social psychology 99(3):467–81

Keser C, Suleymanova I, Wey C (2012) Technology adoption in markets with network effects: Theory and experimental evidence. Information Economics and Policy 24(3):262 – 276, DOI https://doi.org/10.1016/j.infoecopol.2012.03.001

Kinzig AP, Ehrlich PR, Alston LJ, Arrow K, Barrett S, Buchman TG, Daily GC, Levin B, Levin S, Oppenheimer M, Ostrom E, Saari D (2013) Social norms and global environmental challenges: The complex interaction of behaviors, values, and policy. BioScience 63(3):164–175

Knez M, Camerer C (1994) Creating expectational assets in the laboratory: Coordination in weakest-link games. Strategic Management Journal 15:101–119

Kopanyi-Peuker A, Offerman T, Sloof R (2015) Probation or promotion? the fear of exclusion improves team-production. Discussion Paper, University of Amsterdam

Lessig L (1995) The Regulation of Social Meaning. The University of Chicago

Lim W, Neary PR (2016) An experimental investigation of stochastic adjustment dynamics. Games and Economic Behavior 100:208 – 219, DOI https://doi.org/10.1016/j.geb.2016.09.010

Luhan WJ, Kocher MG, Sutter M (2009) Group polarization in the team dictator game reconsidered. Experimental Economics 12(1):26–41

Mackie G (1996) Ending footbinding and infibulation: A convention account. American Sociological Review 61(6):pp. 999–1017

Mannix EA, Loewenstein GF (1994) The Effects of Interfirm Mobility and Individual versus Group Decision Making on Managerial Time Horizons. Organizational Behavior and Human Decision Processes 59(3):371–390

Michaeli M, Spiro D (2017) From peer pressure to biased norms. American Economic Journal: Microeconomics 9(1):152–216, DOI 10.1257/mic.20150151

Miller DT, McFarland C (1987) Pluralistic ignorance: When similarity is interpreted as dissimilarity. Journal of Personality and Social Psychology 53(2):298–305, DOI http://dx.doi.org/10.1037/0022-3514.53.2.298

Munshi K, Myaux J (2006) Social norms and the fertility transition. Journal of Development Economics 80(1):1–38

Neyfakh L (2013) Do handshakes make you sick? The Boston Globe Accessed 20 June 2013

Ochs J (2008) coordination problems and communication. In: Durlauf SN, Blume LE (eds) The New Palgrave Dictionary of Economics, Palgrave Macmillan, Basingstoke

Platteau JP, Camilotti G, Auriol E (2017) Eradicating women-hurting customs: What role for social engineering? WIDER Working Paper, Series "Gender and Development"

Prentice DA (2007) Pluralistic ignorance. In: Encyclopedia of Social Psychology, NBER Chapters, vol 1, SAGE Publications, Inc., pp 674–674, DOI http://dx.doi.org/10.4135/9781412956253

Prentice DA (2012) The psychology of social norms and the promotion of human rights. In: Goodman R, Jinks D, Woods A (eds) Understanding Social Action, Promoting Human Rights, Oxford University Press, pp 23–46

Prentice DA, Miller DT (1996) Pluralistic ignorance and the perpetuation of social norms by unwitting actors. In: Zanna MP (ed) Advances in Experimental Social Psychology, vol 28, Academic Press, pp 161 – 209, DOI https://doi.org/10.1016/S0065-2601(08)60238-5

Romero J (2015) The effect of hysteresis on equilibrium selection in coordination games. Journal of Economic Behavior & Organization 111(C):88–105

Rothenhäusler D, Schweizer N, Szech N (2015) Institutions, shared guilt, and moral transgression. CESifo Working Paper 5525, Munich

Sandstrom M, Makover H, Bartini M (2013) Social context of bullying: Do misperceptions of group norms influence children's responses to witnessed episodes? Social Influence 8(2-3):196–215, DOI 10.1080/15534510.2011.651302

Sherif M (1936) The Psychology of Social Norms. Harper and Brothers.

Singh A, Dhumale R (2000) Globalization, technology, and income inequality: A critical analysis. Research paper, World Institute for Development Economics Research

Tajfel H, Turner JC (1979) An integrative theory of intergroup conflict. In: Austin WG, Worchel S (eds) The social psychology of intergroup relations, Brooks/Cole, pp 33–47

Tajfel H, Turner JC (1986) The social identity theory of intergroup behaviour. In: Austin WG, Worchel S (eds) Psychology of Intergroup Relations, Nelson-Hall, pp 7–24

Van Huyck JB, Battalio RC, Beil RO (1990) Tacit coordination games, strategic uncertainty, and coordination failure. American Economic Review 80(1):234–48

Weber RA (2006) Managing growth to achieve efficient coordination in large groups. American Economic Review 96(1):114–126

Wenzel M (2005) Misperceptions of social norms about tax compliance: From theory to intervention. Journal of Economic Psychology 26(6):862–883

Young S, Hlavka Z, Modiba P, Gray G, Van Rooyen H, Richter L, Szekeres G, Coates T (2010) Hiv-related stigma, social norms, and hiv testing in soweto and vulindlela, south africa. Journal of Acquired Immune Deficiency Syndromes 55(5):620–624

Zeppini P (2015) A discrete choice model of transitions to sustainable technologies. Journal of Economic Behavior & Organization 112:187 – 203

## 6 Appendix

### 6.1 Table of results

**Table 4** Key performance indicators by group

| Group | Treatment | $N$ | $J$ | $\rho_{50}$ | $\bar{\rho}_{(45-50)}$ | $\bar{\rho}_{all}$ | $\bar{\rho}_{(t\geq 26)}$ | $t_{switch}$ | Earnings(€) | Leaders(%) | Testers(%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Full Information | 6 | 8 | 1.00 | 1.00 | .49 | .93 | 26 | 12.32 | 33.33 | 50.00 |
| 2 | Full Information | 6 | 8 | 1.00 | 1.00 | .47 | .91 | 26 | 12.38 | 0.00 | 100.00 |
| 3 | Full Information | 6 | 8 | 1.00 | .97 | .49 | .94 | 26 | 12.49 | 0.00 | 83.33 |
| 4 | Full Information | 6 | 8 | 1.00 | 1.00 | .51 | .99 | 26 | 13.49 | 0.00 | 100.00 |
| 5 | Full Information | 6 | 8 | 1.00 | 1.00 | .49 | .96 | 26 | 13.22 | 0.00 | 83.33 |
| 6 | Full Information | 6 | 8 | 1.00 | 1.00 | .44 | .87 | 27 | 12.48 | 16.67 | 83.33 |
| 7 | Full Information | 6 | 8 | 1.00 | 1.00 | .46 | .88 | 28 | 12.04 | 16.67 | 83.33 |
| 8 | Full Information | 6 | 8 | 1.00 | 1.00 | .50 | .98 | 26 | 13.45 | 0.00 | 100.00 |
| 9 | Communication | 6 | 8 | 1.00 | 1.00 | .44 | .87 | 27 | 13.42 | 0.00 | 100.00 |
| 10 | Communication | 6 | 8 | 1.00 | 1.00 | .49 | .95 | 27 | 13.65 | 0.00 | 100.00 |
| 11 | Communication | 6 | 8 | 1.00 | .97 | .50 | .93 | 26 | 11.98 | 16.67 | 50.00 |
| 12 | Communication | 6 | 8 | 1.00 | 1.00 | .49 | .98 | 26 | 13.70 | 0.00 | 83.33 |
| 13 | Communication | 6 | 8 | 1.00 | 1.00 | .44 | .88 | 28 | 13.67 | 33.33 | 66.67 |
| 14 | Communication | 6 | 8 | 1.00 | 1.00 | .44 | .86 | 26 | 12.83 | 0.00 | 100.00 |
| 15 | Communication | 6 | 8 | 1.00 | 1.00 | .45 | .87 | 27 | 13.10 | 33.33 | 66.67 |
| 16 | Communication | 6 | 8 | 1.00 | 1.00 | .50 | .99 | 26 | 13.79 | 0.00 | 100.00 |
| 17 | SmallStrong | 6 | 8 | .00 | .00 | .03 | .02 | - | 12.39 | 16.67 | 66.67 |
| 18 | SmallStrong | 6 | 8 | .00 | .00 | .05 | .07 | - | 11.77 | 16.67 | 50.00 |
| 19 | SmallStrong | 6 | 8 | .00 | .00 | .02 | .01 | - | 12.78 | 0.00 | 50.00 |
| 20 | SmallStrong | 6 | 8 | .00 | .00 | .05 | .06 | - | 11.77 | 33.33 | 16.67 |
| 21 | SmallStrong | 6 | 8 | .00 | .00 | .01 | .00 | - | 12.90 | 0.00 | 33.33 |
| 22 | SmallStrong | 6 | 8 | .00 | .00 | .02 | .00 | - | 12.49 | 16.67 | 50.00 |
| 23 | SmallStrong | 6 | 8 | .00 | .00 | .03 | .03 | - | 12.38 | 16.67 | 33.33 |
| 24 | SmallStrong | 6 | 8 | .00 | .00 | .02 | .01 | - | 12.72 | 0.00 | 33.33 |
| 25 | SmallWeak | 6 | 4 | .00 | .00 | .04 | .03 | - | 8.76 | 0.00 | 100.00 |
| 26 | SmallWeak | 6 | 4 | .17 | .06 | .03 | .03 | - | 8.76 | 0.00 | 66.67 |
| 27 | SmallWeak | 6 | 4 | .00 | .00 | .03 | .04 | - | 8.84 | 0.00 | 83.33 |
| 28 | SmallWeak | 6 | 4 | 1.00 | .97 | .27 | .49 | 38 | 8.39 | 33.33 | 66.67 |
| 29 | SmallWeak | 6 | 4 | 1.00 | 1.00 | .42 | .79 | 30 | 8.91 | 16.67 | 83.33 |
| 30 | SmallWeak | 6 | 4 | 1.00 | 1.00 | .46 | .85 | 28 | 8.69 | 33.33 | 66.67 |
| 31 | SmallWeak | 6 | 4 | 1.00 | 1.00 | .32 | .62 | 35 | 9.21 | 33.33 | 33.33 |
| 32 | SmallWeak | 6 | 4 | 1.00 | .94 | .48 | .84 | 17 | 8.09 | 16.60 | 66.67 |
| 33 | BigStrong | 11 | 8 | .00 | .02 | .02 | .02 | - | 12.82 | 9.09 | 36.36 |
| 34 | BigStrong | 11 | 8 | .00 | .00 | .03 | .04 | - | 12.28 | 9.09 | 36.36 |
| 35 | BigStrong | 11 | 8 | .09 | .06 | .02 | .02 | - | 12.80 | 9.09 | 36.36 |
| 36 | BigStrong | 11 | 8 | .00 | .02 | .03 | .03 | - | 12.38 | 18.18 | 18.18 |
| 37 | BigStrong | 11 | 8 | .00 | .00 | .04 | .04 | - | 12.04 | 27.27 | 27.27 |
| 38 | BigStrong | 11 | 8 | .00 | .00 | .01 | .00 | - | 13.09 | 0.00 | 27.27 |
| 39 | BigStrong | 11 | 8 | .09 | .02 | .02 | .02 | - | 12.58 | 0.00 | 63.64 |
| 40 | BigWeak | 11 | 4 | .09 | .02 | .01 | .01 | - | 9.07 | 0.00 | 54.55 |
| 41 | BigWeak | 11 | 4 | 1.00 | .98 | .40 | .76 | 32 | 8.97 | 45.45 | 54.55 |
| 42 | BigWeak | 11 | 4 | .91 | .41 | .10 | .18 | 49 | 8.45 | 45.45 | 45.45 |
| 43 | BigWeak | 11 | 4 | 1.00 | .98 | .32 | .62 | 36 | 8.99 | 45.45 | 45.45 |
| 44 | BigWeak | 11 | 4 | .00 | .00 | .02 | .01 | - | 9.00 | 0.00 | 63.64 |
| 45 | BigWeak | 11 | 4 | .09 | .05 | .06 | .09 | - | 8.56 | 36.36 | 36.36 |
| 46 | BigWeak | 11 | 4 | .18 | .09 | .07 | .12 | - | 8.48 | 27.27 | 63.64 |

*Notes:* Values are averages group values. Earnings do not include the €3 show-up fee. $\rho_{50}$ = final group proportion choosing Door A. $\bar{\rho}_{(45-50)}$ = average $\rho$ across the last six rounds. $\bar{\rho}_{all}$ = average $\rho$ across all rounds. $\bar{\rho}_{(t\geq 26)}$ = average $\rho$ from round 26, when the common value of Door B becomes larger than that of Door A. $t_{switch}$ is the first round in which switching groups switched to Door B. *Testers* and *Leaders* are percentages of the respective individual types: Testers deviate from the group norm in one round before reverting back to the group choice, while Leaders deviate from the group norm in at least two consecutive rounds. Highlighted rows are those groups defined as having switched to Door B by the end of the experiment.

## 6.2 Proofs

*Stage-game equilibria*

It follows from the decision rule specified in Proposition 1 that, in equilibrium, we require that players prefer $\omega_i = 1$ at least as much as $\omega_i = -1$ if $d_i < c^*$, that players prefer $\omega_i = -1$ at least as much as $\omega_i = 1$ if $d_i > c^*$ and, in particular, that a player is exactly indifferent between $\omega_i = -1$ and 1 if she draws private values with a difference equal to the threshold $c^*$. We use this latter property of the equilibrium to endogenously calculate the threshold.

The threshold $c^*$ depends both on an individual's beliefs about group behavior as well as the (fixed) social factor. Solving for this threshold allows us to compute a general equilibria condition that holds for any given distribution of the private shocks. Then an individual $i$ maximizing her expected utility chooses $\omega_i = -1$ if $d_i > 2Jm_i^e$. To endogenously solve for an equilibrium, we first rewrite $m_i^e$ as:

$$m_i^e = \frac{1}{N-1} \sum_{k=0}^{N-1} \left( \binom{N-1}{k} p^k (1-p)^{(N-1-k)} (2k - N + 1) \right) \tag{6}$$

where $p$ is the probability of a single draw of $d_i < c^*$ so that $i$ chooses $\omega_i = 1$. Then each term in the series is the expected value for each possible value of $m_i$, which can be written in the form $\frac{2k-N+1}{N-1}$ for each $k \in \{0, N-1\}$.

Letting $m_i^{e*}$ be the equilibrium expected average choice of the others in a group, corresponding to a threshold $c^*$, we can rewrite $c^* = 2Jm_i^{e*}$ in (6). Then solving for an individual $i$ drawing exactly $d_i = c^*$ with $V(-1) = V(1)$ allows us to solve endogenously for the expectation $m_i^{e*} = m_j^{e*} \;\; \forall i, j$:

$$m_i^{e*} = \frac{1}{N-1} \sum_{k=0}^{N-1} \binom{N-1}{k} F(2Jm_i^{e*} - d)^k (1 - F(2Jm_i^{e*} - d))^{(N-1-k)} (2k - N + 1) \tag{7}$$

At first sight, an individual's expectations appears to depend on the size of the group, $N$. We perform the replacements $M = N-1$ and $F = F(2Jm_i^{e*} - d)$ for notational convenience to rewrite (7) as:

$$m_i^{e*} = \frac{1}{M} \sum_{k=0}^{M} \binom{M}{k} F^k (1-F)^{(M-k)} (2k - M) \tag{8}$$

It can be shown that the sum of this series is independent of group size as follows: Let $k$ be a binomially-distributed random variable with parameters $n = M, p = F$. Then $\mathbb{E}(k) = MF$ and so the right-hand side of (8) simplifies to $2F - 1$.

Thus, (7) can be rewritten as $m_i^{e*} = 2F(2Jm_i^{e*} - d) - 1$, which notably does not depend on $N$. Similarly, the researcher's prediction of the expected average choice level of the whole group solves:

$$m^* = 2F(2Jm^* - d) - 1 \tag{9}$$

*Effect of group size*

While group size does not influence the stage-game equilibria, it may still affect the probability of a group switching from a bad equilibrium to a good equilibrium in a given round. Consider a scenario in which the bad norm $\omega_{it} = 1$ is persistent on account of relatively large $J$ and $m_{it}^e$, such that in the majority of rounds $\rho_{it} = 0$. Ex-ante, the probability of an individual choosing $\omega_{it} = -1$ in a given round $t$ is $\hat{\rho}_t$, regardless of the group size. Now consider the rounds in which $0 < \rho_{it} < 0.5$; that is, the bad norm $\omega_i = 1$ is still in effect but *at least one* group member receives a private shock difference large enough to induce choosing $\omega_{it} = -1$. This likelihood is not the same across group sizes. The probability that at least one group member chooses $\omega_{it} = -1$ increases with $N$, and so we would expect *a higher proportion of rounds with* $\rho_{it} \neq 0$ *in larger groups* while the bad norm persists. However, the marginal effect of a group member choosing $\omega_{it} = -1$ on the overall group proportion $\rho_{it}$ decreases with $N$, and so of those rounds where $\rho_{it} \neq 0$ while the bad norm persists, we would expect that $\rho_{it}$ *is higher on average for smaller groups.*

Now, assume there is some 'tipping proportion' $\tilde{\rho}$ that, if reached after a previous equilibrium of full conformity to the bad norm ($\rho^* \approx 0$), would result in a switch to the 'good' equilibrium $\rho^* \approx 1$ with almost certainty. The tipping proportion is greater than the predicted group proportion $\hat{\rho}_t$ so that on expectation it should not be breached in a given round. Then, after a round in which $\rho_{t-1} \approx 0$, the probability of reaching the tipping proportion in round $t$ is the probability that at least $N\tilde{\rho}$ individuals choose $\omega_{it} = -1$. From the researcher's perspective, the number of individuals choosing $\omega_{it} = -1$ follows a binomial distribution so that $N\rho_t \sim \mathcal{B}(N, \hat{\rho}_t)$ and hence:

$$\begin{aligned} \Pr(\rho_t \geq \tilde{\rho}) &= 1 - \Pr(\rho_t < \tilde{\rho}) \\ &= 1 - \sum_{j=0}^{\lfloor N\tilde{\rho} \rfloor} \binom{N}{j} \hat{\rho}_t^j (1 - \hat{\rho}_t)^{N-j} \end{aligned} \tag{10}$$

where $\lfloor N\tilde{\rho} \rfloor$ is the largest integer less than $N\tilde{\rho}$.

This function does not change monotonically with $N$. However, some idea can be garnered as to how the probability is affected across general size increases. The binomial distribution can be approximated by a normal distribution with mean $N\hat{\rho}_t$ and variance $N\hat{\rho}_t(1 - \hat{\rho}_t)$ when $N\hat{\rho}_t > 5$. Assuming this is met, equation (10) can be approximated by:

$$\begin{aligned}\Pr\left(\rho_t \geq \tilde{\rho}\right) &= 1 - \Pr\left(\frac{N(\rho_t - \hat{\rho}_t)}{\sqrt{N\hat{\rho}_t(1-\hat{\rho}_t)}} < \frac{N(\tilde{\rho} - \hat{\rho}_t)}{\sqrt{N\hat{\rho}_t(1-\hat{\rho}_t)}}\right) \\ &\approx 1 - \Phi\Big(\sqrt{N}\frac{\tilde{\rho} - \hat{\rho}_t}{\sqrt{\hat{\rho}_t(1-\hat{\rho}_t)}}\Big) \end{aligned} \tag{11}$$

which, for $\tilde{\rho} > \hat{\rho}_t$, is a decreasing function of $N$.

When a bad norm is in effect, smaller groups are thus *generally* more likely to breach the tipping proportion in a given round. The effect of size on persistence increases slowly and not monotonically, although comparisons can be made for sizes that are not very close together. This is due to the discrete nature of the possible proportions and hence the upper sum limit $\lfloor N\tilde{\rho} \rfloor$.

6.3 Instructions for *SmallWeak* (*N=6, J=4*)

Welcome to this experiment on decision-making. Please read the following instructions carefully. When everyone has finished reading the instructions and before the experiment starts, you will receive a handout with a summary of the instructions. At the start of the experiment, you will be randomly assigned to a group of 6 participants. Throughout the experiment you will stay in the same group. You will play a number of rounds (at least 30, but not more than 80) in which you will make decisions. In the experiment, you will receive a starting capital of 1500 points. In addition, you earn and sometimes lose points with your decisions in the rounds. These amounts will be added to (or subtracted from) your starting capital. At the end of the experiment, your final point earnings will be exchanged for euros. Five points will be exchanged for 1 eurocent. Therefore 500 points will earn one euro.

Each round, every participant in the group will make a decision between “Door A” and “Door B”. The payoff you receive from choosing a particular door in a round will be the sum of two parts, based on:

- Your **private value** for the door (which could be positive, zero or negative), and
- Your **social value** for the door (which could also be positive, zero or negative).

*Private value*

At the start of each round, you will be informed of your own private value for each door. Private values are generated as follows: At the start of a round, we will draw **common values** for each door, which no subject can see and which may change in each new round. The common value for a door will be the same for every participant in your group. However, the two doors will most often have different common values. For each door, we will then draw **individual shocks** for each participant, which again no subject can see. For each door, every participant’s private shock is randomly drawn from a normal distribution (with an average value of 0 and a standard deviation of 10). The graph below clarifies how frequently different private shocks occur.

Each participant receives an independent private shock for each door. Therefore, the private shocks for one participant usually differ from the private shocks of the other participants. We then add the common value for each door to your private shock for that door, which gives you your **private value**. Therefore, for each door, your private value could be higher or lower than the average private value of your group. No other participant can see your private values.

*Social value*

Your social value in a round depends on how many other people in your group make the same door choice as you. You gain if the majority of the other

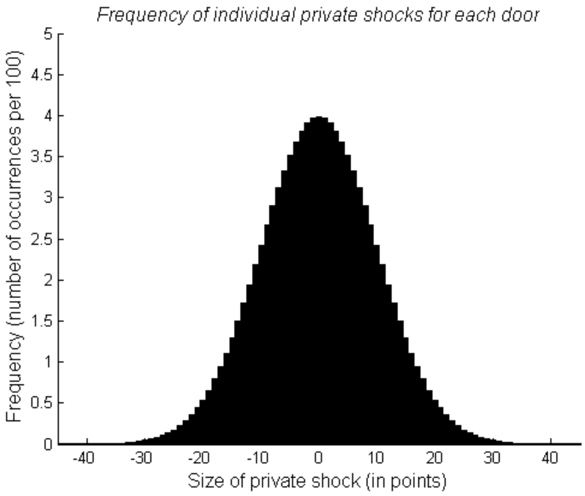


**Fig. 7**

participants make the same choice as you, but you make a loss if the majority makes the other choice. Specifically, you **gain 8 points** for every person who makes the **same** choice as you, but you **lose 8 points** for every person who makes the **opposite** choice to you. As there are five other people in your group, you can get a maximum social value of 40 points if everyone chooses the same door as you, or you can maximally lose 40 points if everyone chooses the other door to you.

The other participants in your group face the same decision as you do. That is, they receive similar information as you do (although their private values will most likely differ), they also choose between Door A and Door B and they make money in the same way as you do.

*Example*

In this game, there are 5 other participants in your group. So, for example, if you choose Door A with a private value of 60 points and 4 others also choose Door A, your payoff equals your **private value** (60) plus a **social value** (32 - 8 = 24), for a **total of 84 points**.

If on the other hand you choose Door B with a private value of 50 points and the 5 others choose Door A, your payoff equals your **private value** (50) *minus* a **social value** of 40 points, for a **total of 10 points**.

*Sequence of events*

Summing up, each round is characterised by this sequence of events:

– At the start of each round, you are told your private values for the doors.

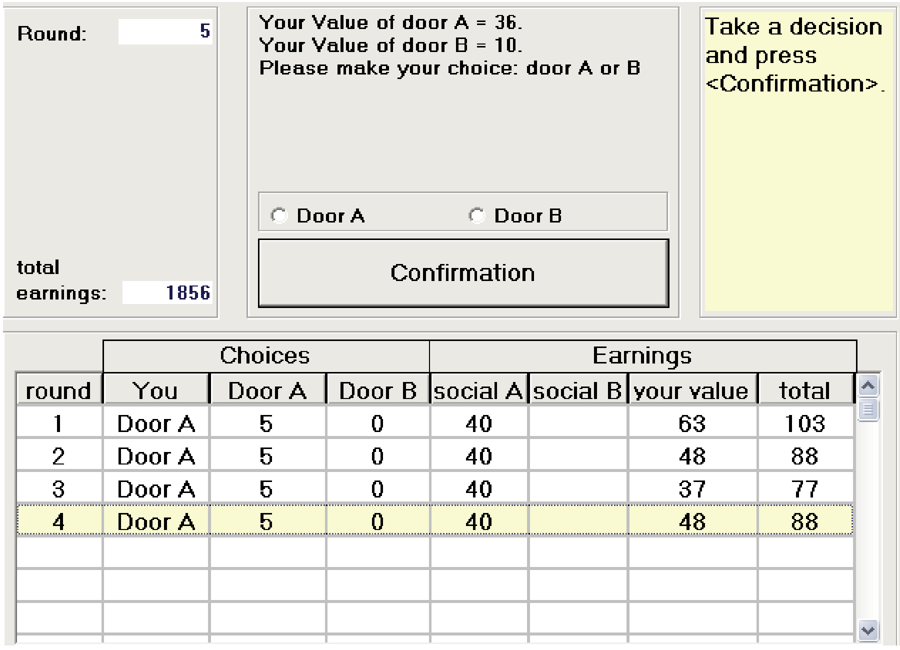


**Fig. 8** Screenshot of individual in *SmallWeak* treatment
*Notes:* Screenshot is taken from the start of round 5. The history footer has a scroll function such that the complete history up until the current round is accessible. Theoretical values were multiplied by 10 in the experiment.

- You make your choice between Door A and Door B.
- At the end of a round, you are told the number of your group members who made each choice, what the social values were for those who chose each door, and you are informed of your payoff in that round. Each round's payoff is the sum of your chosen door's **private value** and your chosen door's **social value**.

Other participants face exactly the same sequence of events.

You can always see the history of the group's choices for all rounds up to that point at the bottom of your screen. You can also always see the sum of the number of points that you earned so far at the top left corner of your screen.

On the next screen you will be requested to answer some control questions. Please answer these questions now.

### 6.4 Instructions for *Communication*

Welcome to this experiment on decision-making. Please read the following instructions carefully. When everyone has finished reading the instructions and before the experiment starts, you will receive a handout with a summary of the instructions. At the start of the experiment, you will be randomly assigned to a group of 6 participants. Throughout the experiment you will stay in the same group. You will play a number of rounds (at least 30, but not more than 80) in which you will make decisions. In the experiment, you will receive a starting capital of 1500 points. In addition, you earn and sometimes lose points with your decisions in the rounds. These amounts will be added to (or subtracted from) your starting capital. At the end of the experiment, your final point earnings will be exchanged for euros. Five points will be exchanged for 1 eurocent. Therefore 500 points will earn one euro.

Each round, every participant in the group will make a decision between "Door A" and "Door B". The payoff you receive from choosing a particular door in a round will be the sum of two parts, based on:

– Your **private value** for the door (which could be positive, zero or negative), and
– Your **social value** for the door (which could also be positive, zero or negative).

*Private value*

At the start of each round, you will be informed of your own private value for each door. Private values are generated as follows: At the start of a round, we will draw **common values** for each door, which no subject can see and which may change in each new round. The common value for a door will be the same for every participant in your group. However, the two doors will most often have different common values. For each door, we will then draw **individual shocks** for each participant, which again no subject can see. For each door, every participant's private shock is randomly drawn from a normal distribution (with an average value of 0 and a standard deviation of 10). The graph below clarifies how frequently different private shocks occur.

Each participant receives an independent private shock for each door. Therefore, the private shocks for one participant usually differ from the private shocks of the other participants. We then add the common value for each door to your private shock for that door, which gives you your **private value**. Therefore, for each door, your private value could be higher or lower than the average private value of your group. No other participant can see your private values.

*Social value*

Your social value in a round depends on how many other people in your group make the same door choice as you. You gain if the majority of the other participants make the same choice as you, but you make a loss if the majority makes the other choice. Specifically, you **gain 8 points** for every person who makes the **same** choice as you, but you **lose 8 points** for every person who makes the **opposite** choice to you. As there are five other people in your

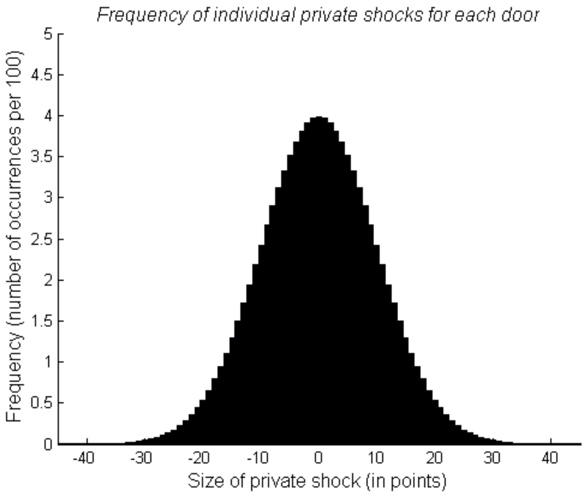


**Fig. 9**

group, you can get a maximum social value of 40 points if everyone chooses the same door as you, or you can maximally lose 40 points if everyone chooses the other door to you.

The other participants in your group face the same decision as you do. That is, they receive similar information as you do (although their private values will most likely differ), they also choose between Door A and Door B and they make money in the same way as you do.

*Example*

In this game, there are 5 other participants in your group. So, for example, if you choose Door A with a private value of 60 points and 4 others also choose Door A, your payoff equals your **private value** (60) plus a **social value** (32 - 8 = 24), for a **total of 84 points**.

If on the other hand you choose Door B with a private value of 50 points and the 5 others choose Door A, your payoff equals your **private value** (50) *minus* a **social value** of 40 points, for a **total of 10 points**.

*Bulletin Board*

In every round, **before you choose your door**, you can indicate your intentions. On the *Bulletin Board*, which everyone can see, you can choose to post that you intend to choose Door A or Door B. Posts are **anonymous** and there is no obligation to honour your posts. Alternatively, you can also elect not to post anything. After everyone has made their decision about posting for that round, you will be able to see the total number of posts for Door A and Door B on the *Bulletin Board* before finally choosing your door.

*Sequence of events*

Summing up, each round is characterised by this sequence of events:

- At the start of each round, you are told your private values for the doors.
- You can choose either to anonymously post on the *Bulletin Board*, or not to post at all.
- You see the number of posts for each door on the *Bulletin Board*.
- You make your choice between Door A and Door B.
- At the end of a round, you are told the number of your group members who made each choice, what the social values were for those who chose each door, and you are informed of your payoff in that round. Each round’s payoff is the sum of your chosen door’s **private value** and your chosen door’s **social value**.

Other participants face exactly the same sequence of events.

You can always see the history of the group’s choices for all rounds up to that point at the bottom of your screen. You can also always see the sum of the number of points that you earned so far at the top left corner of your screen.

On the next screen you will be requested to answer some control questions. Please answer these questions now.

### 6.5 Instructions for *Full Information*

Welcome to this experiment on decision-making. Please read the following instructions carefully. When everyone has finished reading the instructions and before the experiment starts, you will receive a handout with a summary of the instructions. At the start of the experiment, you will be randomly assigned to a group of 6 participants. Throughout the experiment you will stay in the same group. You will play a number of rounds (at least 30, but not more than 80) in which you will make decisions. In the experiment, you will receive a starting capital of 1500 points. In addition, you earn and sometimes lose points with your decisions in the rounds. These amounts will be added to (or subtracted from) your starting capital. At the end of the experiment, your final point earnings will be exchanged for euros. Five points will be exchanged for 1 eurocent. Therefore 500 points will earn one euro.

Each round, every participant in the group will make a decision between “Door A” and “Door B”. The payoff you receive from choosing a particular door in a round will be the sum of two parts, based on:

- The **common value** of the door (which is the same for all participants),
- Your **private value** for the door (which could be positive, zero or negative), and
- Your **social value** for the door (which could also be positive, zero or negative).


**Fig. 10**

*Common value*

At the start of a round, you will be told the common value for each door, which everyone can see, and which may change in each new round. The common value for a door will be the same for every participant in your group. However, the two doors will most often have different common values.

*Private value*

At the start of each round, you will be told your private value for each door, which will be the same for every round and which no other participant can see. For each door, every participant's private value is randomly drawn from a normal distribution (with an average value of 0 and a standard deviation of 10). The graph below clarifies how frequently different private values occur. Each participant receives an independent private value for each door. Therefore, the private values for one participant usually differ from the private values of the other participants. Your private values are the same for every round in the experiment.

*Social value*

Your social value in a round depends on how many other people in your group make the same door choice as you. You gain if the majority of the other participants make the same choice as you, but you make a loss if the majority makes the other choice. Specifically, you **gain 8 points** for every person who makes the **same** choice as you, but you **lose 8 points** for every person who makes the **opposite** choice to you. As there are five other people in your group, you can get a maximum social value of 40 points if everyone chooses the same door as you, or you can maximally lose 40 points if everyone chooses the other door to you.

The other participants in your group face the same decision as you do. That is, they receive similar information as you do (although their private values will most likely differ), they also choose between Door A and Door B and they make money in the same way as you do.

*Example*

In this game, there are 5 other participants in your group. So, for example, if you choose Door A with a common value of 80 points, a private value of -10 points and 4 others also choose Door A, your payoff equals the **common value** plus your **private value** (80 + 10 = 70) plus a **social value** (32 - 8 = 24), for a **total of 94 points**.

If on the other hand you choose Door B with a common value of 40 points and a private value of 20 points, and 5 others also choose Door B, your payoff equals the **common value** plus your **private value** (40 + 20 = 60) plus a **social value** of 40 points, for a **total of 100 points**.

*Sequence of events*

Summing up, each round is characterised by this sequence of events:

- At the start of each round, you are told your constant private values for the doors.
- At the start of each round, you are told the new common values for the doors.
- You make your choice between Door A and Door B.
- At the end of a round, you are told the number of your group members who made each choice, what the social values were for those who chose each door, and you are informed of your payoff in that round. Each round's payoff is the sum of your chosen door's **common value**, your **private value** and your chosen door's **social value**.

Other participants face exactly the same sequence of events.

You can always see the history of the group's choices for all rounds up to that point at the bottom of your screen. You can also always see the sum of the number of points that you earned so far at the top left corner of your screen.

On the next screen you will be requested to answer some control questions. Please answer these questions now.

## 7 Material for online appendix

The main purpose of extending the analysis to a dynamic setting is to generate testable hypotheses and motivate the parameters of the experiment. We are interested in situations in which the common values are constant for some time, such that we can investigate stable (or 'equilibrium') group behavior.

We assume that the expectations-formation process is homogeneous in the sense that for a given round $t$, players form their expectations about the rest of the group's behavior, $m^e_{it}$, via a common function $\psi$.[18] This function depends on the only two pieces of information available to individuals: the difference in their private values, and the common historical 'norm'. We assume that $i$'s expectation about the average group choice $m^e_{it}$ is decreasing in her private value difference $d_{it}$, because while individuals do not know the common values, they are aware that the other members' private values are positively correlated with their own private values. We further assume that $i$'s expectation positively depends on the common norm. Past history has been shown to play a role in equilibrium selection in similar coordination games in the lab, which motivates and supports this dependence (Romero 2015; see also Cason et al 2012, Huck et al 2011, Cooper and Kagel 2003).

When $|d_{it}|$ exceeds $2J$, individual $i$'s private value difference is so high that she no longer considers social interactions at all, and so restrictions on expectations for our purposes need only address $\psi$ for the range $d_{it} \subset [-2J, 2J]$. Given the foundations above, a plausible and parsimonious function for the formation of individuals' expectations in round $t$ is:

$$\psi(d_{it}, m_{t-1}) = \delta m_{t-1} - (1-\delta)\frac{d_{it}}{2J}, \qquad \delta \in [0,1] \tag{12}$$

Here, $m_{t-1}$, the group choice of the previous period, represents a simplified form of a common norm. The second term, $-\frac{d_{it}}{2J}$, describes a negative linear relationship between $i$'s expectations of the proportion of the group choosing $\omega = -1$ and her private value difference $d_{it}$ in the range $d_{it} \subset [-2J, 2J]$. Finally, $\delta$ represents how an individual weighs the new information stemming from her private values against this group norm. Section 2.4 uses an equal weighting ($\delta = 0.5$) as illustration; here, we generalize the analysis. This weighting parameter will play an important role in predicting which equilibrium evolves. In contrast to Brock and Durlauf's (2001) setup, individuals will have different expectations about the behavior of others, depending on the realisation of their own private values.

Consider a period of rounds in which the difference in the common values, $d_t$, is constant. $\psi(d_{it}, m_{t-1})$ can be thought of as a belief-updating process that guides individuals' choices towards a stable, long-run 'equilibrium proportion'

[18] Time subscripts are now introduced into the notation in order to describe the dynamic environment.

choosing $\omega_{it} = -1$. When $|d_t|$ is very small (relative to $J$), the system moves faster towards equilibrium for high $\delta$ because individuals are congregated by the existing norm, although the equilibrium may not be the socially optimal choice. The current norm helps individuals overcome their coordination difficulties, but in doing so can entice the group to forego potential social welfare. When $|d_t|$ is very large, the system can stabilize quickly even for low $\delta$, as normative effects are not needed for coordination on the superior choice.

The expectation formation process (12) enables a researcher who knows the common values and the distribution of the private shocks (though not their realizations) to predict both the average group choice $m_t$ in a given round and, if the common values remain constant, the dynamically-stable equilibria over the period.

If individuals form expectations of group behavior according to (12) and the difference in common values is constant over time, $d_t = d$, then a stable equilibrium expected average group choice at the end of the period solves:

$$m^* = 2F\left(\frac{2J\delta}{2-\delta}m^* - d\right) - 1 \tag{13}$$

The proof is trivially similar to that of (4) in the stage game. Recall that an individual $i$ does not know the common values and thus the distribution of private values from which those of the other group members are drawn. Substituting (12) into the threshold decision rule, $i$ chooses $\omega_{it} = -1$ if $d_{it} > 2J\left(\delta m_{t-1} - (1-\delta)\frac{d_{it}}{2J}\right)$, which can be rewritten as:

$$d_{it} > \frac{2J\delta}{2-\delta}m_{t-1}$$

Note that $\frac{\delta}{2-\delta}m_{t-1}$ corresponds directly to $c^*$, the equilibrium threshold. Following similar sum-of-series calculations to (7) leads to an equilibrium average group choice prediction in a given round $t$ of the form of (13), but with time subscripts. Then in a period in which $d_t = d_{t+1} = d$ we replace $m_{t-1} = m_t = m^*$ in expectation for the stability of an equilibrium, which leads immediately to (13).

We now turn to the question of when a bad norm can persist in a dynamic setting. First, we rewrite (13) in terms of the equilibrium proportion of the group choosing $\omega_i = -1$ at the end of the period:

$$\rho^* = F\left(d - \frac{2J\delta(1-2\rho^*)}{2-\delta}\right) \tag{14}$$

The same graphical argument of the stage game dictates that for strictly unimodal distributions, there can again be at least one and at most three solutions to (13). Let the private shocks once more be normally distributed according to $\epsilon(\omega_{it}) \sim \mathcal{N}(0,1)$. Then the difference in private shocks has a cumulative distribution function following $\Pr\left(\epsilon_{it}(-1) - \epsilon_{it}(1) < x\right) = \Phi\left(\frac{x}{\sqrt{2}}\right)$, and (14) becomes:

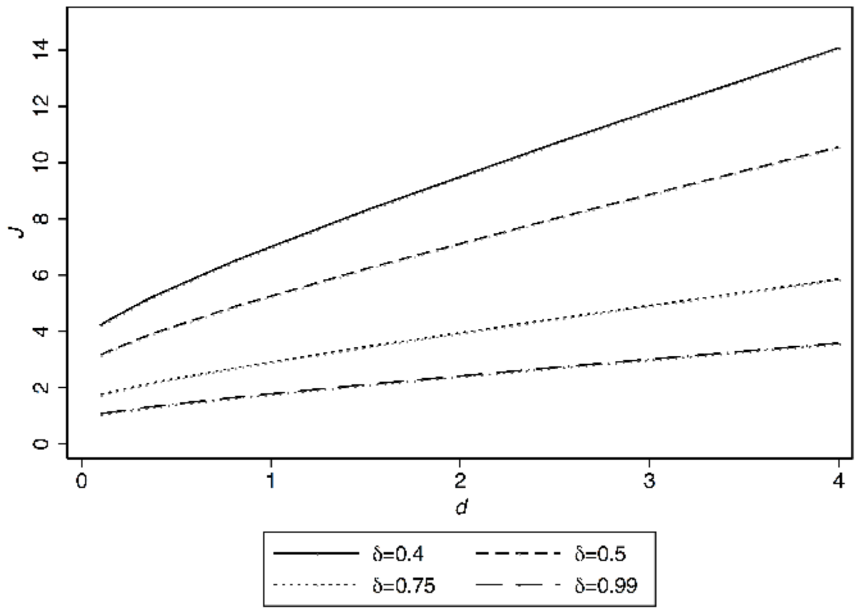


**Fig. 11** Minimum theoretical $J$ required for bad and good norm coexistence.
*Notes:* Values are numerically calculated from (15) with $d$-intervals of 0.001. Individuals are assumed to follow a homogeneous threshold rule based on weighing their private values and group norm expectations in the form of (12) with different weighting parameters $\delta$. Private shocks for each choice and individual are distributed $\sim \mathcal{N}(0,1)$.

$$\rho^* = \Phi\left(\frac{d}{\sqrt{2}} - \frac{2J\delta(1-2\rho^*)}{\sqrt{2}(2-\delta)}\right) \tag{15}$$

We say that a bad norm persists when $\rho^* \approx 0$ is a possible equilibrium during a sufficiently long period of time in which choice $\omega_i = -1$ is generally preferable from a group welfare perspective. As long as the difference in common payoffs, $d$, is large enough relative to the social factor, $J$, the only sustainable long-run equilibrium in the system is the 'good' norm $\rho^* \approx 1$. However, when $d$ is small relative to $J$ so that social value is relatively more important than individualistic returns, two stable equilibria emerge: $p^* \approx 0$ and $p^* \approx 1$. By way of an explicit example, for $d$-values from 0 to 4, the minimum value of $J$ for which both a bad norm of $\rho^* \approx 0$ and a good norm of $\rho^* \approx 1$ can persist is shown in Figure 11.

Continuing the example, consider the parameter space $d = 2$, $J = 8$, and the normal shock distribution described above. Figure 11 shows that for $\delta = 0.5$, a bad norm $\rho^* \approx 0$ can persist. To investigate the likelihood of this occurring, this system was simulated for a group of 100 individuals with self-fulfilling expectations $m_i^e$ following the form of (12) and $\delta = 0.5$. The initial

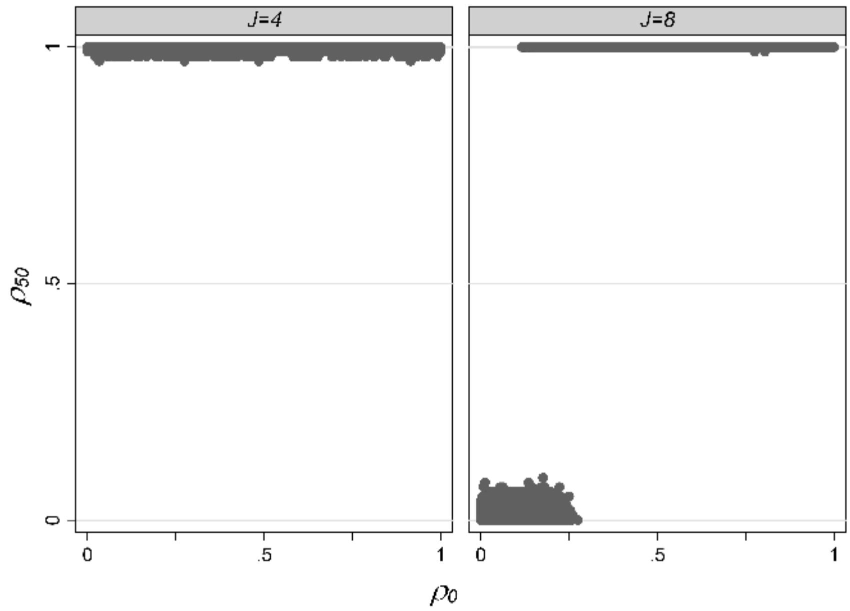


**Fig. 12** Simulated equilibria for fixed common value difference $d = 2$ and other parameters $J = 4, N = 100, \delta = 0.5$.
*Notes:* $\rho_t$ gives the proportion of individuals choosing $\omega_i = -1$ in a round $t$. Starting proportions are taken from $\sim \mathcal{U}(0, 1)$ across 100,000 simulations of 50 rounds. Individuals are assumed to have expectations of the form specified in (12) with $\delta = 0.5$.

proportion $\rho_0$ choosing $\omega_i = -1$ was uniformly distributed over $[0, 1]$ and, for each starting value, the game was played for 50 rounds. From 100,000 simulations the bad norm persisted approximately 20% of the time, requiring less than a quarter of the population initially choosing $\omega_i = -1$. Figure 12 shows the result of these simulations. When $J$ is reduced below the persistence threshold to 4, the system stabilizes at $\rho^* \approx 1$ in every simulation; the group always switches to the good norm after 50 rounds. If $d_t$ is allowed to vary slightly around a mean of 2, the results generally hold. Bad norms are now less likely to exist for $J = 8$, but this reduction comes solely from initial values around $\rho_0 = 0.25$; the results are unchanged for initial proportions close to 0.

The results of these simulations motivate the choice of the social factors we use to test the model in the lab. To further draw closer the theory and experiment, we now tailor the analysis to the specific parameterizations of the experiment. This has the interesting feature that we can compare, according to the theory, under which circumstances our groups of subjects in the experiment should shift their equilibrium choice. We simulate the specific treatments in our $2 \times 2$ design for the parameter combinations $J = \{4, 8\}, N = \{6, 11\}$. We use the same sequence of common values across 50 rounds that our participants face, in which $d_t \approx 2$ for rounds 25-50 after a norm of $m_t \approx 1$ has been induced.

Individuals in the simulations form expectations using (12), and we allow $\delta$ to vary in order to investigate when treatment groups can 'break' the bad norm by coordinating on the good equilibria $m^* = -1$.

Figure 13 displays the results. Clear social factor effects can be seen; for the weaker $J = 4$, a much larger weighting on the existing norm is required for the bad norm $\rho = 0$ to persist as the equilibrium. In addition, group size plays almost no role in the simulated equilibria, although slight differences can be detected at the critical $\delta$ levels where equilibria switch. These differences are consistent with the theoretical predictions about group size discussed in the main Appendix. Specifically, the model predicts that for small $N$, smaller groups are slightly more likely to switch away from a bad norm in the short run, and would be expected to do so faster. Between groups of very large sizes, however, the effect of $N$ on bad norm persistence becomes negligible.

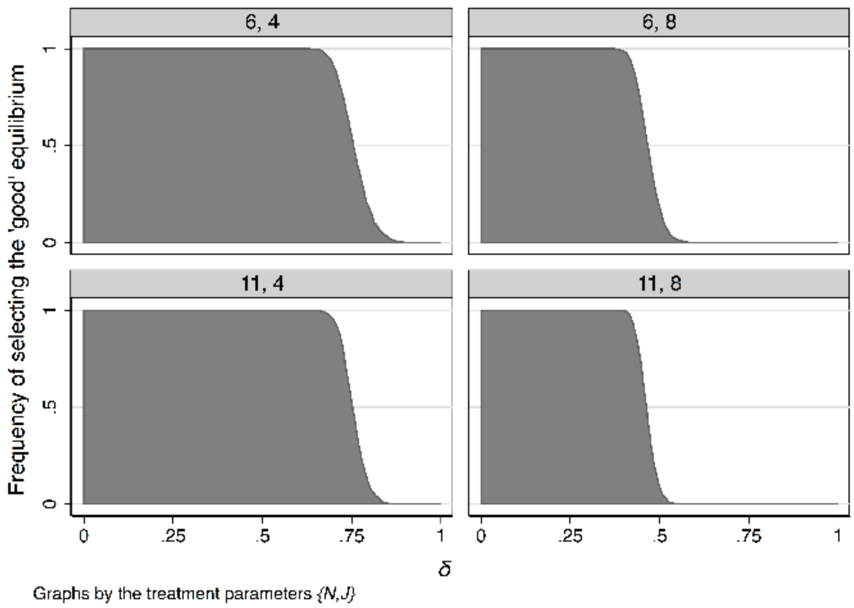


**Fig. 13** Equilibrium selection from simulations
*Notes:* Results are reported for $\delta$-values ranging from 0 to 1 in steps of 0.001, with each being simulated 1,000 times per treatment. Each simulation used the common values shown in Figure 1.

*Pluralistic Ignorance*

The experimental test of the pluralistic ignorance perspective of bad norm persistence uses a treatment in which individuals know the common values as well as the distribution of private shocks. The full information may affect individuals’ expectations about group behavior, as has been demonstrated in many other experimental games. In this context, individuals form their expectations on the basis of the common values, rather than their own private values, and moreover, the certainty provided by information about common utility logically prompts more weighting on this component of expectations formation function. We now propose to reconcile these results with the preceding theoretical analysis. Let $\delta'$ represent the weighting parameter for an individual, who otherwise forms expectations with $\delta$, in the presence of full information. Then $\psi(d_{it}, m_t) = \delta' m_{t-1} - (1-\delta')\frac{d}{2J}, \quad \delta' \in [0,1]$, where it is assumed that $\delta' < \delta$. It follows that the equilibrium condition for a stable average group choice becomes:

$$m^* = 2F\left(2J\delta' m^* - (2-\delta')d\right) - 1 \tag{16}$$

The effect of full information on bad norm persistence is not trivial when contrasted with respect to the previous analysis. The substitution of the common values for an individual’s private values in the expectations formation function increases the scope for the ‘bad’ equilibrium to emerge, while the lower weighting parameter has the opposite effect. However, in terms of sensitivity, persistence is extremely responsive to changes in $\delta$; a very small decrease in an individual’s weighting of the existing group norm causes a large reduction in the scope of bad norm persistence for a given $\{d, J\}$ parameter space. Given this, we may expect that the absence of uncertainty over the common values significantly decreases the reliance on historical norms for an individual’s expectation about future group behavior. In the extreme case in which $\delta' = 0$, the equilibrium condition reduces to $m^* = 1 - 2F(2d)$, which gives only one ‘good’ equilibrium for given common values and no longer depends on the social factor at all.

*Communication*

The results of the communication treatment can be reconciled in a similar manner. Past experiments have found a positive effect of communication on equilibrium selection. Choi and Lee (2014) find that coordination is enhanced by allowing communication in networks. However, in their experiment the roles of implicit agreement and punishment from deviations are necessary for improving coordination. Ochs (2008) shows that the effect of communication can differ in different coordination games; interestingly, this paper also highlights the role of past precedent, a mechanism that in our experiment corresponds to the strength of the bad norm. In our experiment, we are particularly interested in anonymous signalling that one might expect from posting on internet bulletin boards or social media. While this cheap talk is non-binding, it again can be thought of as shifting the focus away from historical precedent and towards illuminating present group preferences. Such a shift lowers $\delta$, which we predict should decrease the probability of bad norm persistence.

*Estimating $\delta$*

One of the predictions of the theoretical analysis is that individuals place less weight on the group norm when forming expectations in environments of greater certainty of others' preferences. That is, the coordination benefits of having more information or being allowed to communicate manifest themselves in a lower weighting parameter $\delta$. We now compare estimates of $\delta$ in the *Communication* and *Full Information* treatments to those of the baseline design in *SmallStrong*. As opposed to the model's simulations, we now allow individuals in a group to have heterogeneous values for $\delta_i \in [0, 1]$. We estimate the range of an individual's true $\delta_i$-value from her choice behavior in the experiment under the assumption that subjects followed the threshold decision rule of Proposition 1 and the simple belief-updating rule of (12) in a consistent manner. An individual using this belief-updating process chooses $\omega_{it} = -1$ (Door B in our experiment) in round $t$ if and only if $d_{it} > \frac{2J\delta_i}{(2-\delta_i)} m_{t-1}$. Then, depending on the private values and group norm in a particular round, the choices of an individual who behaves consistently narrow the ranges of our estimate of her true value. We use the midpoints of each individual's estimated bounds for $\delta_i$ after 50 rounds in order to compare the weighting parameters of the *Full Information* and *Communication* treatments to those of the corresponding baseline treatment *SmallStrong* (Figure 14).

Consistent with our theoretical predictions, the addition of communication or full information to the setup significantly lowers the weight that individuals place on the group norm in forming their expectations. For $N = 6$ and $J = 8$, the estimated $\delta$-values are noticeably lower in the *Full Information* and *Communication* treatments than in the baseline treatment *SmallStrong*. These differences are highly significant ($p = .00$ for both two-way $t$-test comparisons).[19] The results are interesting in the context of our theoretical analysis in that they support the prediction of a lower weighting of the group norm where there is reduced uncertainty about others' choices.

[19] There are no significant differences in estimated $\delta$-values between *Communication* and *Full Information*, nor among the baseline treatments.

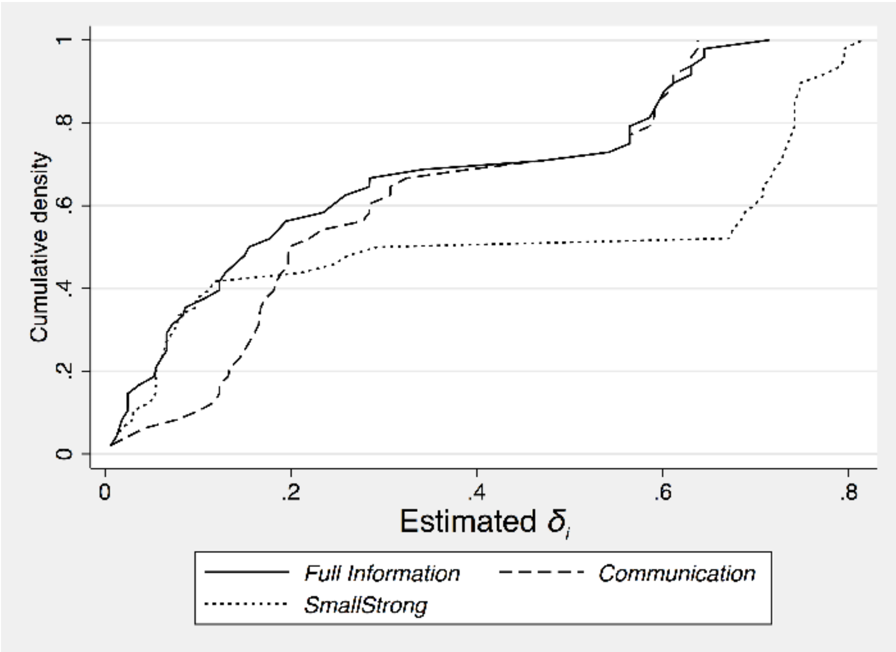


**Fig. 14** Cumulative distribution plots for estimates of $\delta_i$ by treatment
*Notes:* CDFs are of the midpoint of the estimated range of the weighting parameter $\delta$ for each subject, given her choices in the experiment and assuming a belief-updating process described in (12). For each of the three treatments, $N = 6$ and $J = 8$. The results suggest that subjects in the *Full Information* and *Communication* treatments of the experiment placed less weight on the group norm in forming their expectations about others' choices.